FLIGHT

The AIRCRAFT ENGINEER & AIRSHIPS

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CONTENTS

DIARY OF CURRENT AND FORTHCOMING EVENTS

Club Secretaries and others desirous of announcing the dates of important fixtures are invited to send particulars for inclusion in this list—

1928

June 26-29 F.A.I. Annual Conference, Brussels
June 29—July 15 Paris Aeronautical Salon
June 29 .... Annual Dinner of R.A.F. Club
June 29 .... Royal Air Force Dinner Club, Sixth Annual Dinner at Connaught Rooms, 8 p.m.
June 30 .... Royal Air Force Display, Hendon
June 30 .... Gordon Bennett Balloon Race, Detroit, U.S.A.
June 30 .... American Inter-Collegiate Air Race
July 6-7 Blackpool Flying Meeting

EDITORIAL COMMENT

IT is often said that in the future, commercial aviation must, of necessity, be largely international in character. Although the latest transatlantic flight was scarcely commercial, it complied amply in other respects with that dictum. Financed, it is said, by the American wife of a British ex-Air Minister; carried out on a machine designed by a Dutchman and constructed in the United States; powered by three engines of all-American origin, as 100 per cent. American as even "Big Bill Thomson" could ask for; piloted by an American citizen who, however, judging by his name is not likely to be of Scottish descent; and carrying an engineer who obviously is. While the lady passenger wears a wealth of fair hair and a name which may at one time have been spelled Ehrhardt. The first stage of the flight was from American to British waters, and the first contact with the United Kingdom took place in Wales.

A Mixed Affair

The machine itself was in some ways just as much of a curiosity: a high-wing monoplane, with three engines and twin floats. But it got across, even if the margin was uncomfortably narrow. On alighting off Burry, the pilot is reported to have said that he had not enough petrol to take off again. The machine had, however, passed near or over portions of Ireland, so that if necessary a descent could have been made there.

Well, the first lady passenger has crossed the Atlantic by air, although what special merit there is in that is not altogether easy to see. In these days of sex-equality, such a feat should not arouse any particular comment. Compared with the solo flights of such lady *pilots* as Lady Bailey and Lady Heath, the crossing of the Atlantic as a *passenger* does not appear to us to prove anything in particular. If it were intended to demonstrate that a machine can now cross the Atlantic carrying a full crew and even a passenger, then that was proved by Commander Byrd's flight last year, and very much more convincingly.

If anything useful is to be gleaned from this latest

flight, it would seem to be that the particular machine is not over efficient as a seaplane, since it repeatedly refused to get off with a quantity of petrol on board commensurate with the requirements. Only by relieving it of more and more load was it possible to get the machine off, and although the flight succeeded, the quantity of petrol was only just sufficient. The fact that wireless was carried, and that the machine, being a float seaplane, might have had a chance of surviving for a short time in case of a forced descent, was in favour of the flight. There is little doubt that some of the land machines which have been lost have flown into the sea and gone straight on to the bottom without giving the crew a chance, leaving behind on the surface only a few pieces of broken wing.

The advocates of three-engined machines may derive a measure of support from the fact that another machine of this type has got across. In fact, so far no three-engined machine has failed to get across, while quite a number of single-engined machines have been lost. Also the "Friendship" established a "record" by being the first seaplane to make the crossing via the northern route.

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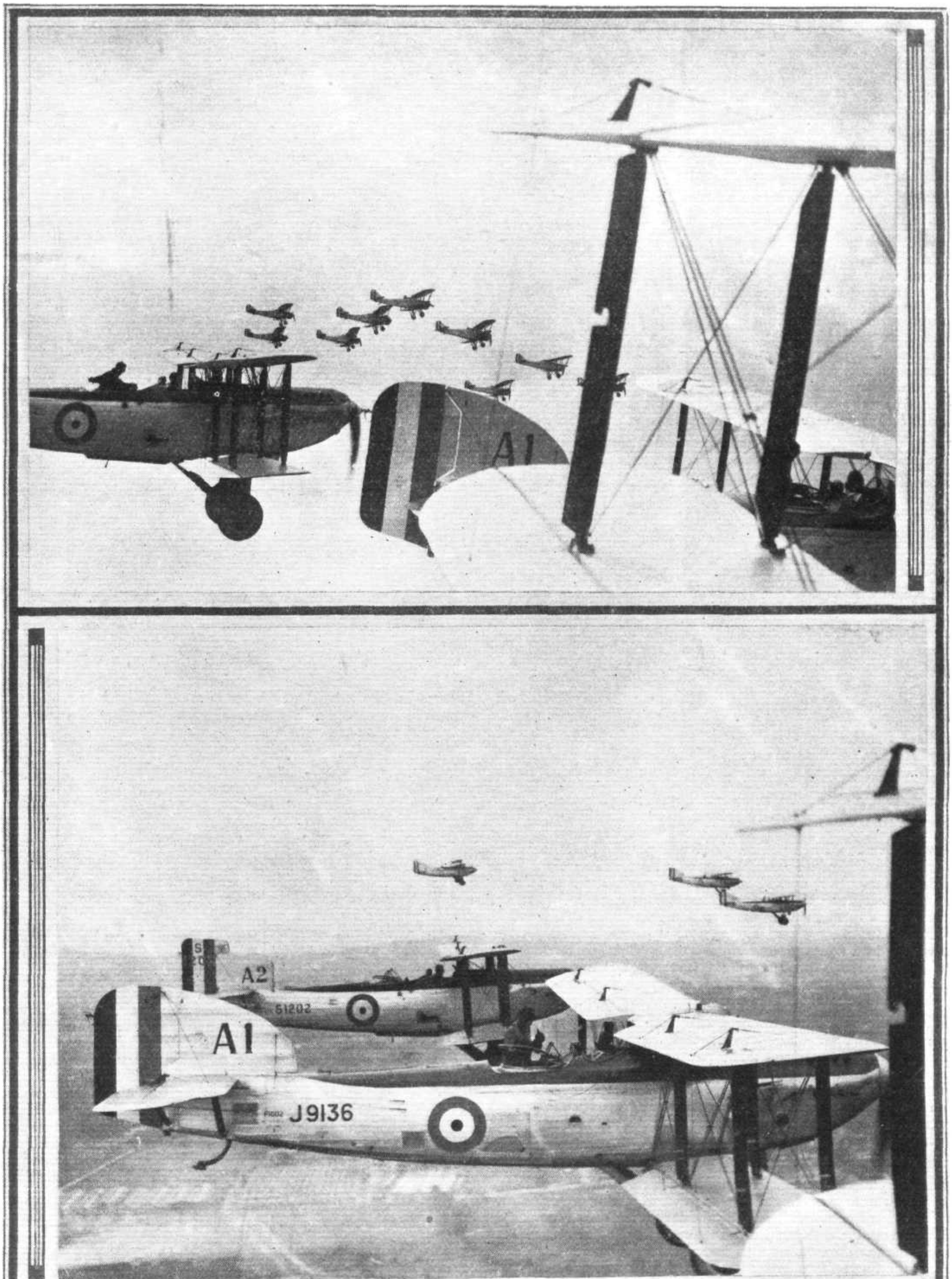
Arctic Flying

Flying under arctic conditions may be said to have been proved quite feasible. Capt. Sir Hubert Wilkins, a brief report of whose paper is published this week, has demonstrated this, not merely by his flight from Alaska to Spitzbergen, but also, and much more so, by his flights covering several thousand miles in the Arctic during the last three years. His experiences are of very considerable value to the aviation community. Space does not permit of referring here to more than one or two aspects. The possibility of keeping warm in a single skin suit of the type made by the Eskimo women is interesting. The necessity of wearing it next to the skin may prove a bit of a hindrance, but the possibility of being able to substitute such a suit, weighing but a few pounds, for the cumbersome electrically-heated suits should not be overlooked. One does not, of course, know whether there is some subtle difference between low temperature due to latitude and low temperature due to altitude. But it might be worth while to look into the subject a little more closely.

The subject of ice collecting on a machine does not yet seem to have been definitely settled. Sir Hubert Wilkins has not personally had any trouble due to this cause, although others, flying under identical conditions, have had trouble. Cooling, or rather the prevention of overcooling, still appears to be a problem in the case of air-cooled engines, and as there must be considerable similarity between an air-cooled engine flying at a few thousand feet in the Arctic regions and a modern single-seater fighter with supercharged engine flying at something like 30,000 ft., the problem of arranging for variable cooling is still one of importance.

ATLANTIC FLIGHT: (Left to Right)—the Hon. Mrs. Guest, Mr. Gordon (mechanic), Miss Earhart, Com. Stultz (pilot) and the Mayor of Southampton, Mrs. Foster Welch, at Southampton, after the arrival of the "Friendship" on June 19 from South Wales

FLIGHT



["FLIGHT" *Photographs*

AT HENDON : These are views taken from a Fairey IIIF machine over Hendon of the R.A.F. machines practising during the week for the Display on June 30. (Top) Fairey IIIF's are in the foreground and Flights of Hawker "Horsleys" in the distance. (Below) Close-up view of the Fairey IIIF's taken from the starboard machine of the Flight by our photographer.

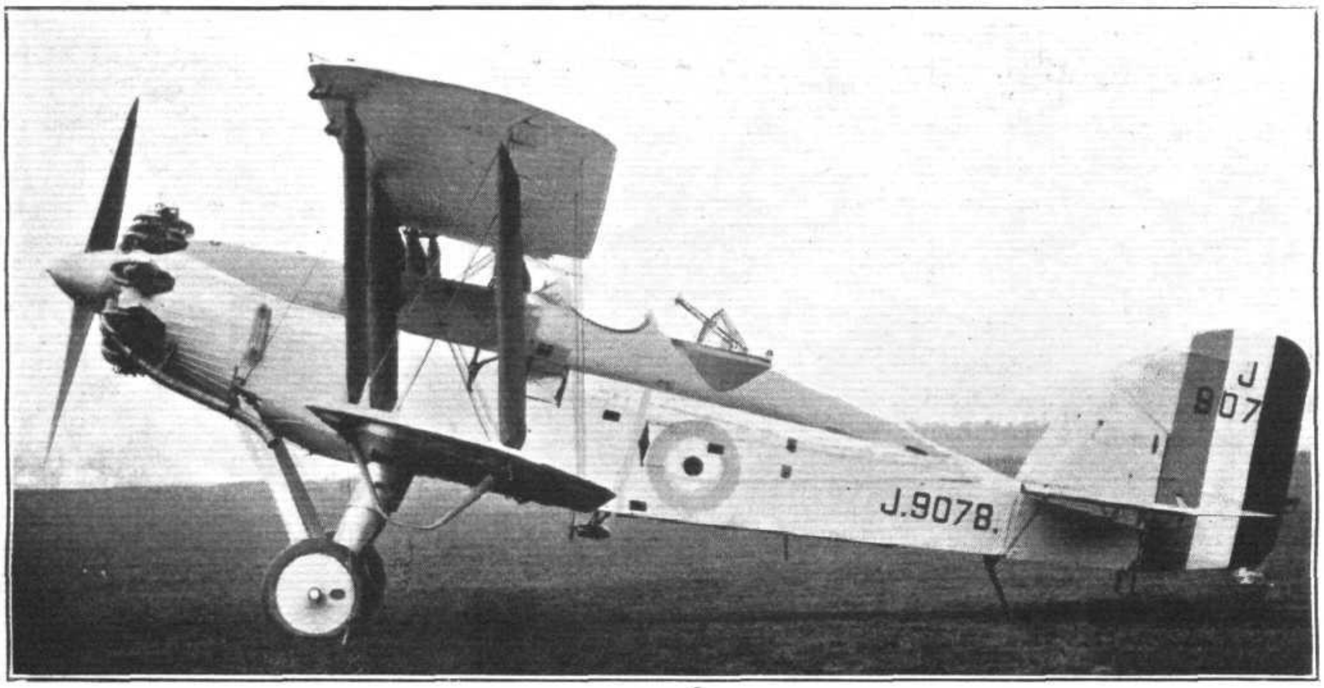
THE WESTLAND "WAPITI"

Bristol "Jupiter VI" Engine

THE "Wapiti," designed and constructed by the Westland Aircraft Works of Yeovil, is of the type known as a "General Purpose" machine, *i.e.*, suitable for bombing, reconnaissance, photography, wireless and advanced training. It can be supplied either in composite timber and metal construction or as an all-metal machine. In both cases the wing covering, and that of control surfaces, fuselage rear portion, etc., is fabric.

In its general design the "Wapiti" is a normal two-bay wire-braced biplane, and in view of the ample stowage accommodation which its function as a general purpose machine requires, it is of remarkably small dimensions and "clean" design, with a very good performance. The amount of gear that has to be carried in a machine of this type is prodigious, and it is to the credit of the Westland designers that they have managed to provide all the space required while still retaining such a good performance.

In the lay-out of the "Wapiti" a great deal of attention has been paid to the subject of view. Thus it will be seen that the deck of the fuselage is raised considerably, bringing the pilot's head up to a level where he can look either over or under the top centre-section, the cockpit being so far aft that the small cut-out in the trailing edge provides an unobstructed view upwards. The gunner, being placed relatively far aft, has an excellent view in all directions. Features such as these, coupled with the good performance, ample stowage space and general simplicity of construction and reduction in maintenance cost, were doubtless instrumental in securing the order for "Wapitis" which the Air Ministry has placed with the Westland firm. At the moment it is rumoured that one of these machines is to be placed at the disposal of His Royal Highness the Prince of Wales, and it would probably be difficult to find a machine better suited to the carrying of a passenger whose life is so valuable to the Empire.



THE WESTLAND "WAPITI": This side view gives a good idea of the general lines of the machine, which is a General-Purpose aircraft, fitted with Bristol "Jupiter VI" engine. It can also be supplied with "the Jupiter VIII," when the performance is considerably improved.

Constructional Features

The fuselage of the Westland "Wapiti" is built up of three units, comprising the engine plate and first bay, the portion from the first bay to aft of the pilot's cockpit, and thence to the stern post. In the composite machine the first two units are of metal construction, the rear section having wood members and being braced by tie rods and, in places, by the plywood covering. In the all-metal machine the rear portion is also of metal construction.

The first two fuselage units are built up of square-section drawn Duralumin and steel tubes, steel being employed for the most highly stressed members. The assembly of struts and longerons is by means of flitch plates, so that repairs are a relatively simple matter and require no very careful fitting by hand. At the joints the stresses are not taken on the butt ends but on the rivets, which are designed with sufficient bearing area to take the loads.

As already mentioned, the rear portion of the fuselage is, in the composite machine, a wooden structure braced by tie rods. The top and bottom portions are covered with plywood, thus forming rigid members. The front portion of the fuselage is covered with aluminium sheet, with longitudinal corrugations to give stiffness. Where it is necessary to gain access to the interior of the fuselage or to the engine components, cowling panels are arranged to be detached by means of special flush-fitting clips.

The wings of the composite type of machine are of normal construction, with spars spindled out to an I section and built-up wooden ribs of normal type. The interplane struts are of spruce, and streamline in section. If desired, the "Wapiti" can be supplied fitted with the new Handley Page automatic wing tip slots, which enable lateral control to be maintained in the stalled condition.

The ailerons are of the Bristol-Frise type, in which the balance is obtained by locating the hinges some distance back from the leading edge of the aileron. This type of aileron is becoming very popular indeed, and is to be seen nowadays on a large number of British aircraft. In the "Wapiti" the ailerons are balanced statically as well as aerodynamically. In the all-metal type of machine, the wings and ailerons are of metal construction, but no details are available concerning the forms of construction employed.

The tail units of the composite and all-metal types are interchangeable, and in both the front spar forms the hinge while the rear spar is actuated by the trimming gear, which gives a range of angular movement of 7 degrees. The rudder is of large area, and has a horn balance making it very light in operation.

The undercarriage is of V-type, with the front legs acting as radius members and the rear legs telescopic. The front legs are circular section steel tubes with wood fairings, while the oleo legs are faired in by ribbed aluminium casings. Of the patented Westland oleo-pneumatic type, the telescopic legs are capable of having their capacity for absorbing shock varied according to the weight of the machine. Owing to the relatively low air pressures employed; this type of oleo leg has proved very satisfactory in use. There is no difficulty in keeping the legs airtight, and little attention is needed.

The engine mounting in the "Wapiti" has been so designed that either the "Jupiter VI," the "Jupiter VIII," or the "Jupiter X" can be accommodated. The engine mounting is a flanged steel plate, to which is riveted a machined Duralumin face to form the engine bed. This bed is rigidly braced by a structure of square-section tubes which needs no attention after rigging. The installation is very accessible, and the mounting is simple, robust and free from vibration. All engine fittings are very accessible, as the cowling can be removed in less than two minutes. The fireproof bulkhead is located well behind the engine and allows plenty of room for working on the engine components.

The engine can be started in three ways: Either by Hucks starter, by Bristol gas starter, or by sucking in by swinging the propeller and using the hand starter magneto. Alternatively, the Viet hand compressor starting system can be fitted.

Under normal conditions of flying, the fuel supply is contained in two tanks, both located inside the fuselage ahead of the pilot's cockpit. The gravity tank has a capacity of 40 gallons and the main tank holds 68 gallons. The tanks are of welded aluminium, and the main tank is cylindrical and slung in straps anchoring it to curved aluminium brackets. To remove the tank it is only necessary to uncouple the pipes, take out two bracing wires, and after slackening the straps the tank can be slipped through the bottom of the fuselage. The gravity tank can be taken out of the machine through the top of the fuselage after the cowling is removed. The main tank feeds petrol to the gravity tank by means of a windmill-driven pump. In case of failure of this, the fuel is transferred to the gravity tank by a hand pump. For special long-distance flying a third tank of 23 gallons capacity is fitted. The oil tank is placed over the first bay of the fuselage, and the top surface is left exposed to the air for cooling and a five-element Vickers-Potts cooler is used. Normally, 11 gallons of oil are carried, but for long-distance flying the tank is filled up with 15 gallons.

Armament

Armament for both defensive and offensive operations is carried. The former consists of a Vickers 0·303-inch air-cooled gun carried on an adjustable exterior mounting on the port side, and of a Lewis gun on a Scarff ring.

The offensive equipment comprises bombs and bomb gear, with a course-setting bomb sight used by the observer in the prone position. The release of the bombs can be controlled from either cockpit. A total load of 580 lb. of bombs can be carried, the number and size of bombs within this limit being arranged as desired. The ammunition box for the Vickers gun holds 600 rounds in a belt, and for the Lewis gun, in the rear cockpit there are six magazines of 97 rounds each.

For photographic duties an aircraft camera is carried in the bay behind the observer's cockpit. It operates through a rectangular hole in the floor of the fuselage.

A supply of oxygen is available for pilot and observer, fittings being placed in both cockpits and the gunner having two points of supply, one for use when standing and the other for the prone position. The master control is in the hands of the pilot.

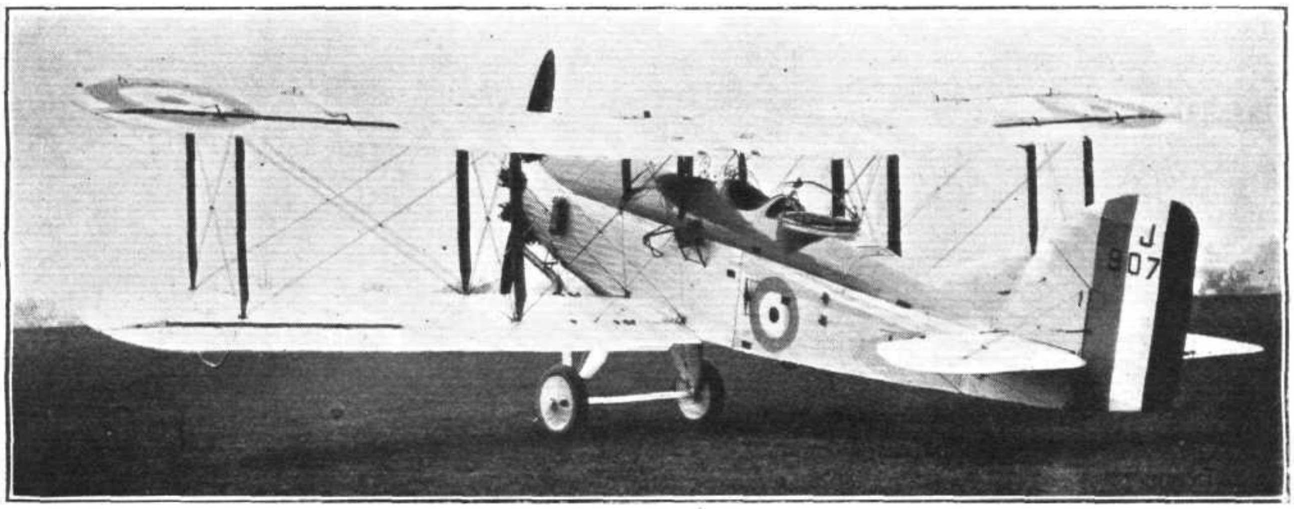
The machine is equipped for wireless transmission and reception, the instruments being fitted inside the deck fairing aft of the observer's cockpit. The wireless compartment is open to the observer, and the folding seat is so arranged that it is usable when the observer faces aft. In this position a tapping key is within reach of his right hand. The generator is fitted on the starboard side and is therefore free from risk of damage by spent cartridges from the Vickers gun.

Long-Distance Equipment

When the machine is required to undertake long flights over desert routes, for instance, additional fuel and oil with an increased complement of equipment are carried. Special provision has been made to carry the additional equipment, spares and rations entirely stowed inside the fuselage, the machine then carrying an extra 600 lb. above its normal load.

The internal stowage of the equipment is a great point in favour of the "Wapiti," as no articles are carried outside where they would offer extra head resistance, and detract from the performance. The success of the design in this respect is brought out in the performance figures for normal and special load, from which it will be seen that the difference in speed at 10,000 ft. is only 3 miles per hour.

The additional equipment consists of the auxiliary petrol tank and its fuel, a spare wheel, a spare tail skid, a fitter's tool box, engine spares, emergency rations, normal rations, water, personal equipment, bedding, etc. The whole of this equipment and the necessary structure for carrying it is easily removable, so that no extra weight is involved when the equipment is not required.



THE WESTLAND "WAPITI": Three-quarter rear view. The particular machine illustrated is fitted with Handley-Page slots.

Main Dimensions: Wing span, 46 ft. 5 in.; chord, 5 ft. 9 in.; wing area, 488 sq. ft.; gap, 5 ft. $10\frac{3}{8}$ in.; stagger, 1 ft. 4 in.; incidence, 3 degrees; dihedral, 3 degrees; length o.a., 31 ft. 8 in.; height, 11 ft. 10 in.; wheel track, 6 ft.

Fuel and Oil Capacity: Petrol (normal), 108 gallons; oil (normal), 11 gallons; petrol (long-distance), 131 gallons oil (long-distance), 15 gallons.

Weights and Loading: Weight of machine, empty, 2,644 lb.; fuel weight, 696 lb.; disposable load, 900 lb. Total loaded weight (with normal load), 4,240 lb. Total loaded weight (with long-distance equipment), 4,838 lb. Wing loading (normal), 8·7 lb./sq. ft. Wing loading (long-distance), 9·9 lb./sq. ft.

Performance

	Normal weight.		Long-distance.	
Altitude.	Rate of Climb.	Speed.	Rate of Climb.	Speed.
Ft.	Ft./min.	m.p.h.	Ft./min.	m.p.h.
2,000	1,055	129	730	—
5,000	1,050	133	760	130
10,000	750	129	510	126
15,000	480	123	270	118

Service ceiling (*i.e.*, height at which rate of climb is 100 ft./min.), 22,700 ft. The engine cannot be opened out fully below a height of 5,000 ft. Minimum take-off run, 95 yards; minimum distance to clear a screen 50 ft. high, 200 yards. Landing run, 126 yards. Landing speed, 50 m.p.h.

Service ceiling, 18,800 ft. Take-off run, 166 yards. Minimum distance to clear screen 50 ft. high, 250 yards. Landing run, 169 yards. Landing speed, 53·3 m.p.h.

ANOTHER ATLANTIC FLIGHT

THE first seaplane of the pontoon type to fly the Atlantic is a Fokker FVII monoplane fitted with three Wright "Whirlwind" (200 h.p.) engines. It brought the first woman air passenger across the Atlantic, Miss Amelia Earhart. The pilot was Commander Wilmer Stultz, and Mr. Gordon was the mechanic. This seaplane, named the "Friendship," left Trepassey, Newfoundland, at 2.51 p.m. on June 17, and landed at Burry Port near Llanelly on the South Wales coast at 12.40 p.m., the following day, June 18. Thus the journey took about 21 hours for a distance of 2,100 miles, and the speed was 100 m.p.h.

It was only after very many attempts that the seaplane lifted off the water at Trepassey, and only with a reduced load of petrol. About 770 gallons were on board. Bad weather reigned after the American coast was left, and, owing to the load, it was some time before much altitude could be gained. Wireless communication enabled them to pick up the positions of two ships. About two hours after the start they reported passing over Grand Banks, 61 miles east of Cape Race, and an hour later the White Star liner *Albertic*, which left Montreal on June 14 for Southampton, was in communication, and received word that all was O.K. At 6.5 p.m. the machine reported to the liner, *Concordia*, that it was making 110 m.p.h., and at 8.45 p.m. the Liverpool steamer, *Rexmore* was asked for its position by loud signals, although the monoplane itself was not seen. After another message at 10.30 p.m., nothing was heard for several hours; then at 10.30 the following morning, the machine circled the liner, *America*, 72 miles east of Queenstown. Notes were dropped, but failed to hit the mark.

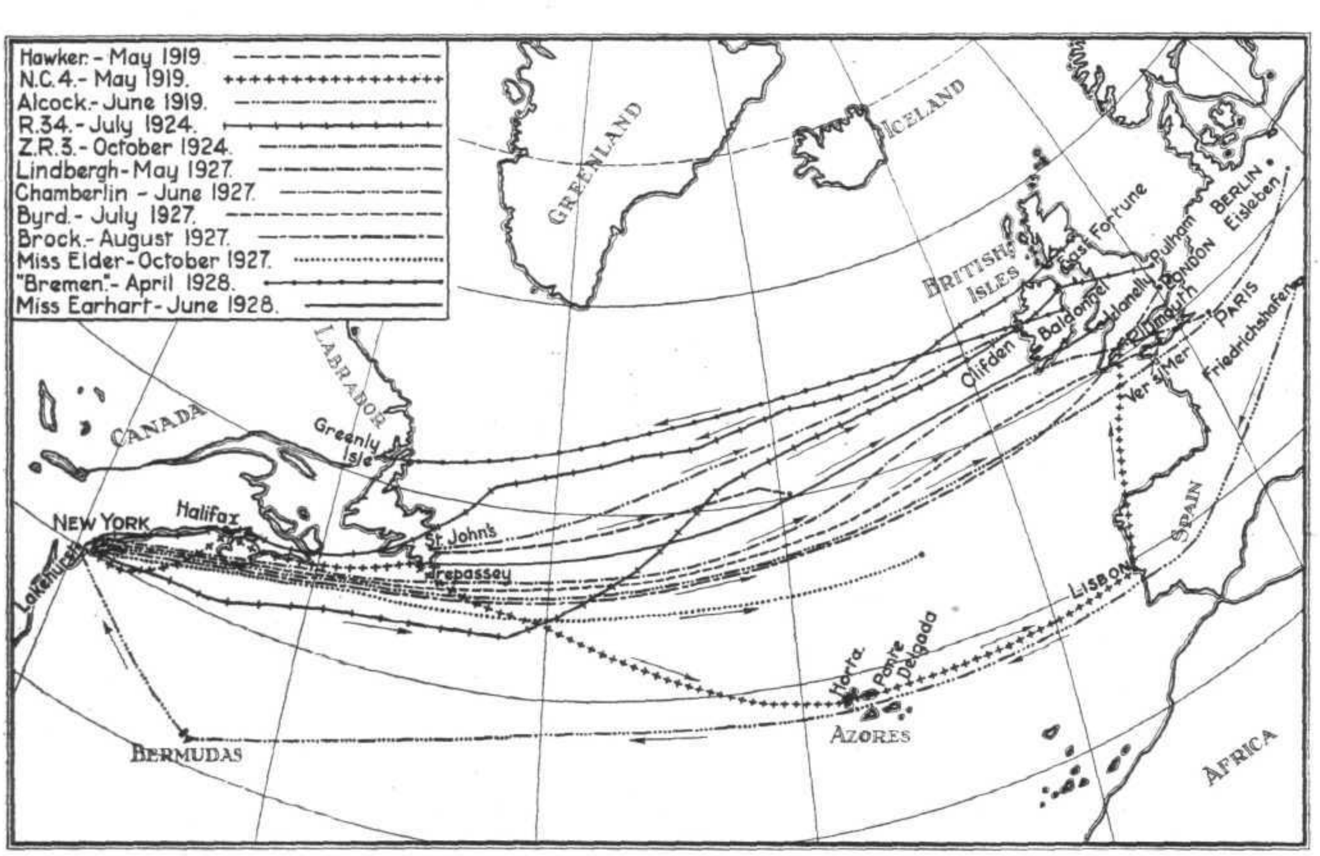
Shortly after midday the machine was heard over Llanelly, and it finally landed at 12.40 p.m. and taxied towards a buoy in Burry Port. When boats drew alongside the air crew, queried their position, and on being informed they stated they thought it was the Bristol Channel. Petrol had run out, otherwise it was their intention to land at Southampton.

Commander Stultz went ashore to arrange for further supplies of petrol, but Miss Earhart and Mr. Gordon remained on board. Meanwhile Mrs. F. E. Guest, wife of Capt. F. E. Guest, awaited them at Southampton. Mrs. Guest, who is an American, financed the flight to the extent of £8,000. Capt. Railey, who was the agent in this country, arrived by air from Southampton.

Commander Wilmer Stultz was the pilot to Mrs. Grayson last year during her many futile attempts to cross the Atlantic in the Sikorsky "Dawn." Fortunately, he was not with her on her final fatal attempt when the machine disappeared on the first stage from New York to Newfoundland and the entire crew were lost. He is 28 years of age, and served in the Army Air Service from 1917 to 1919, then three years in the Naval Air Service. In 1923 he went to South America for the Curtiss Aeroplane Co. to deliver 40 machines to the Brazilian Navy, which he erected and then tested. Later he entered commercial aviation.

Mr. Gordon, his mechanic, was also in the Army Air Service, and has been with the Reynolds Airways as flight mechanic for two years.

Miss Earhart is an experienced pilot, and is 30 years of age. She belongs to Atchison, Kansas, served in the Canadian Red Cross in 1917–18, and then entered the Columbia University. Her recent work has been among children at a social centre in Boston.



ATLANTIC FLIGHTS: The above sketch map shows the various Atlantic flights, successful and otherwise, made since 1919.

Mrs. Guest was herself desirous of taking part in the flight, but was persuaded not to, and she gave the opportunity to Miss Earhart, who kept her plans silent. It is said that her parents were not aware of her intentions until they read of them in the press. Mrs. Guest's main object was to ensure that a seaplane equipped with wireless was used, and a woman given the honour of crossing the Atlantic. Also she wished to assist in promoting Anglo-American relations. A lighter touch to the flight was the suggestion of competition between her and Miss Mabel Boll, who has been anxious to fly the Atlantic either way in any way and at any cost for some time. It was uncertain who would start first, but now that she has been robbed of the honour it is her reported intention of shipping her monoplane, "Miss Columbia," to England, and essaying an east-to-west flight. Commander Stultz was her pilot, until he suddenly joined Miss Earhart's party, much to the former lady's consternation.

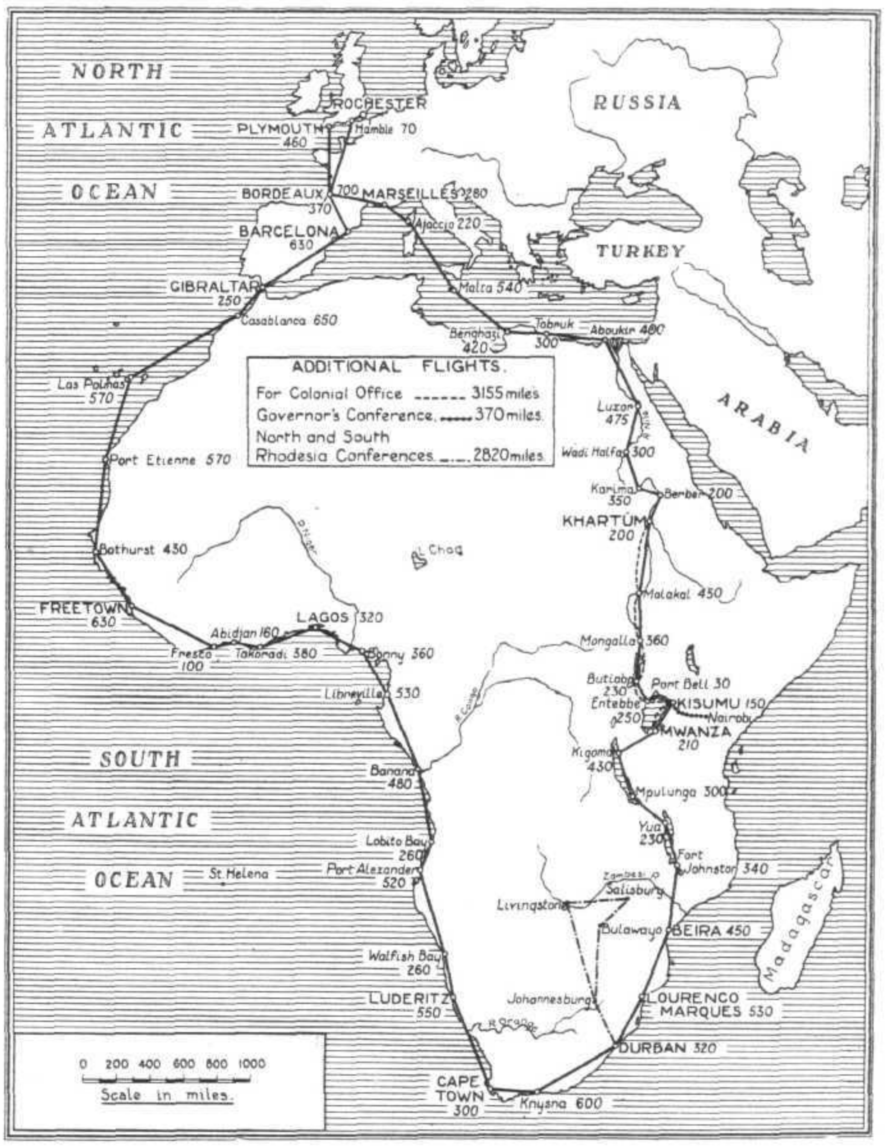
The following telegram was sent by Sir Samuel Hoare, the Secretary of State for Air; to the United States Ambassador in London :—"Please accept and convey to Miss Earhart and Mr. Wilmer Stultz and their companions, the Air Council's warm congratulations on successful completion of their Atlantic flight."

(*Concluded on page 476*)

AFRICAN SURVEY FLIGHT

IN our recent issues we have recorded in detail the arrival home of the Sir Charles Wakefield African survey expedition, the cruise round England and summarised the objectives and accomplishments of the survey itself. There now remains as the final word a summarised story of the actual progress of the African flight with statistics of the stages covered and places visited. Sir Alan Cobham started from Rochester on November 17 in the Short "Singapore" (Condors), crossed London, followed the Thames as far as Reading, and then cut across country to Southampton Water, where he arrived in two hours. Bad weather then caused a delay until November 20, when the next stage to Hourtin (Bordeaux) was flown in $8\frac{1}{2}$ hours in fairly good weather; distance, 700 miles. By the afternoon of November 21 Marseilles, 280 miles across country, was gained, and the next day Ajaccio, 220 miles, was covered in 3 hrs. 33 mins., in face of bad conditions. Rain fell continuously, a head wind prevailed, and the harbour where the landing was effected was very rough. Those conditions caused further brief delay, then, as darkness was falling on November 24, the flying-boat descended on Malta at St. Paul's Bay, and was moored for the night near the *Queen Elizabeth*, on which Sir Alan and his party were entertained for the evening. That stage of 540 miles in strong head winds took 8 hrs. 25 mins. The following morning the flying-boat was towed into calmer waters, and then ascended for the Calafrana seaplane base, where it landed alongside a pinnace, which began to tow the machine in a heavy swell across the bay. When roughly 400 yards from the base the pinnace turned at right angles to the jetty, which brought the machine broadside to the rollers, causing it to tilt acutely and dip the starboard wing. The starboard float was washed away, and in the ensuing struggle for the shelter of the cliffs some of the crew had to mount the port wings to trim the machine. For three days the machine remained there, with the pinnace standing by. Then, the wind having dropped, the seaplane base was reached in safety.

But one afternoon the worst of gales sprang up, and the port float was observed to be sinking, and the necessity of beaching the machine was realised. In the heavy waves the port float was swept away and the wing began to sink. Capt. Worrall and Mr. Bonnett, the cinematographer, and six Air Force men dived in and clambered on the other wing, without, however, making much difference. Finally, with the assistance of 200 helpers, the flying-boat was dragged on to the slipway.



AFRICAN SURVEY FLIGHT: Our sketch map traces in detail the aerial survey carried out by Sir Alan Cobham in the Short "Singapore" (Condors) flying-boat round Africa and the additional minor flights.

Messrs. Short Bros. manufactured a new metal wing in record time, and it was sent out to Malta. On January 21 the flight was resumed, and Benghazi, 420 miles, was reached, whilst the next day came Tobruk, 300 miles, where the Italians gave facilities for refuelling. Aboukir, 400 miles, came on January 22, and five days later Luxor, 475 miles, after a flight down the Nile. A visit was paid to the Valley of the Kings. After the next stage of 300 miles to Wadi-Halfa on January 29, a forced landing occurred at Berber, Sudan, owing to a sandstorm, but two days later a landing was made on the Blue Nile in front of the Palace at Khartoum, 200 miles farther on. Meanwhile Sir Alan had drawn up a report on the possibilities of Malta as an air base which the Malta authorities had requested him to do after his visit. In this he mentioned that the majority of machines leaving that island for their next destination would be heavily loaded with fuel, and that therefore the aerodrome site must allow for an exceptionally long run. He described five possible sites and two seaplane bases.

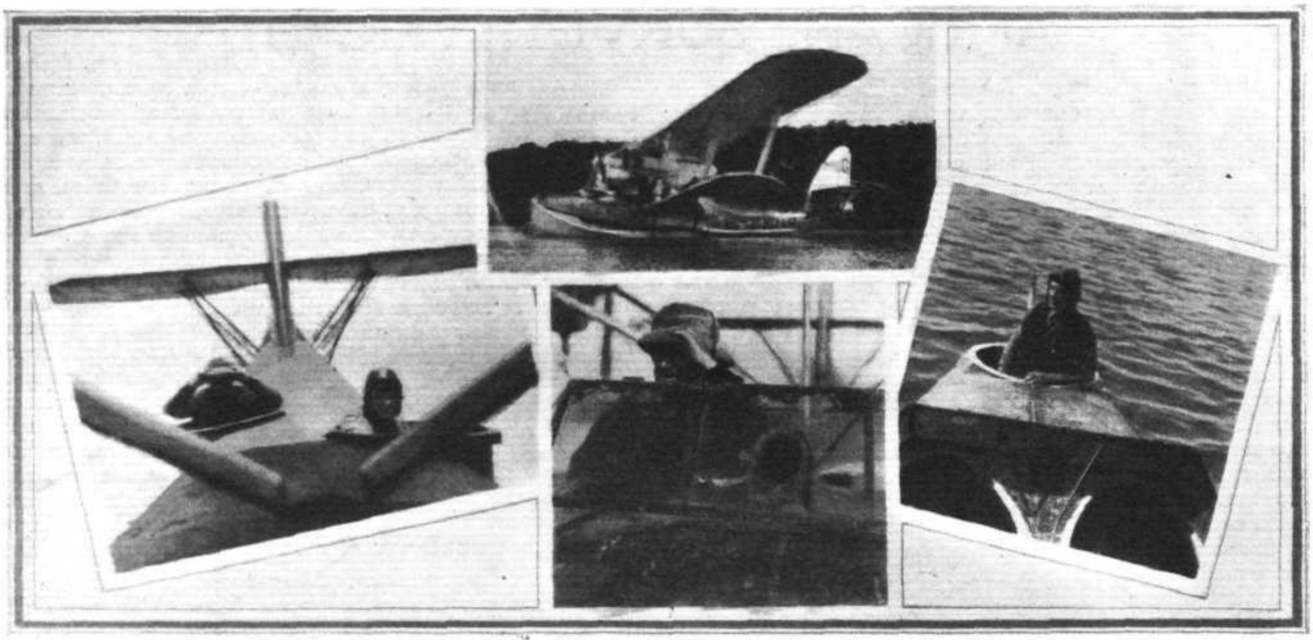
On the resumption of the survey, Malakal, 450 miles was reached from Khartoum, then Mongalla, 360 miles, and Butiaba, 230 miles.

The flying-boat descended on Lake Victoria in Central Africa at Entebbe, nearly 4,000 ft. above sea level, on February 5. That was the first time a flying-boat had landed there.

London to Entebbe had taken 70 flying hours. A special contract for a return flight from Lake Victoria to Khartoum was carried out by Sir Alan. The journey was flown in four days, the distance being 3,155 miles, and the longest stage of 820 miles, Khartoum to Mongalla, was flown in 8 hrs. 40 mins. When the survey southwards was resumed Kigoma, 430 miles from Mwanza, Mpulunga, 300 miles, Yua, 230 miles, Fort Johnson, on the southern extremity of Lake Nyasa, 340 miles, and Beira, 450 miles, were covered by March 4. Two days later a flight of 530 miles brought the expedition to Lourenco Marques. There was a respite at Durban, which was reached on March 8 after $4\frac{1}{4}$ hrs. flying over a distance of 320 miles, and, purely as a matter of precaution, the machine was overhauled. Sir Alan cabled his appreciation of the Rolls-Royce "Condors" which had completed 150 hrs. in varying climatic conditions without faltering.

Knysna, 600 miles, was the next stage covered, then came 300 miles flying on March 30 to Cape Town. That completed the outward journey from England.

The return journey up the West African Coast was started on April 3 with a flight of 550 miles in 7 hrs. to Luderitz.



THE SIR CHARLES WAKEFIELD SURVEY FLIGHT AROUND AFRICA: Some snapshots en route. On the left, Sir Alan and Lady Cobham have a peep out of the starboard and port, respectively, rear cockpits of the Short-Rolls-Royce "Singapore," while flying at 100 m.p.h. In the centre (top) the "Singapore" moored at Frisco Lagoon, and (below) Sir Alan "surveying" Africa from the pilot's cockpit in mid-air. On the right is Capt. Worrell, second pilot of the expedition.

A gale was blowing when the ascent was made from Simon's Bay, Cape Town. On April 5 they reached Walfish Bay, 260 miles, in a gale and thick fog. Port Alexander, 520 miles, April 6, Lobito Bay, 260 miles, April 7, followed in turn, then a 480-mile stage to Banana Creek at the mouth of the Congo River on April 8. There a member of the crew, Mr. F. Green, the engineer, had to leave the flying-boat owing to illness against which he had been fighting since the start from Cape Town. He was left in charge of a doctor on a Belgian Government steamer. On the following day Libreville, 530 miles, was gained.

Bonny, 360 miles, and Lagos, 320 miles, were visited by April 11, eight days out from Cape Town. Sir Alan considered that the weather in general on the West African Coast was excellent for flying, with two bad exceptions. There were thick fogs between Luderitz and Walfish Bay and constant southerly winds which would severely hinder southward flights. From Cape Town to Lobito Bay was continuous desert for 500 miles, and no habitation or water other than at his landing places, and possibly a few others. Although there was no shelter for seaplanes, an aeroplane service could operate all the way to Lobito Bay.

The expedition remained at Lagos for four days, and went to Takoradi on April 15, 380 miles away, followed then by Abidjan, 160 miles, and a forced landing at Fresco Bay on the Ivory Coast on April 17, after a stage of 100 miles. It was necessary to wait spare parts from England, and it was a month all but two days before the flight was resumed on May 15. Freetown, 630 miles, Bathurst, 430 miles, Port Etienne, 570 miles, and Las Palmas, 570 miles, were all covered by May 22. After that the stages which concluded the flight were: Casablanca, 650 miles, May 26; Gibraltar, 250 miles, May 27; Barcelona, 630 miles, May 28 (in a gale); Bordeaux, 370 miles, May 29; and Plymouth, 460 miles, on May 31 (*via* Brest and Guernsey). After that began the round England cruise, recorded in last week's issue.

About 20,000 miles were flown on the survey flight in Africa, and, in addition, Sir Alan flew 3,155 miles for the Colonial Office; 370 miles to the Governors' Conference; and 2,820 miles for the North and South Rhodesian Conferences.

The log of the cruise is as follows:—

Nov., 1927.
17. Rochester-Southampton (70 miles)
20. Southampton-Bordeaux (700)
21. Bordeaux-Marseilles (280)
22. Marseilles-Ajaccio (220)
24. Ajaccio-Malta (540)

Jan., 1928.
21. Malta-Benghazi (420)
22. Benghazi-Tobruk (300)
23. Tobruk-Aboukir (400)
27. Aboukir-Luxor (475)
29. Luxor-Wady Halfa (300)
29. Wady Halfa-Karima (350)
30. Karima-Berber (200)
31. Berber-Khartoum (200)

Feb.
2. Khartoum-Malakal (450)
3. Malakal-Mongalla (360)
4. Mongalla-Butiaba (230)
5. Butiaba-Entebbe (250)
6. Entebbe-Port Bell (30)
6. Port Bell-Kisumu (150)
7. Kisumu-Mwanza (210)
25. Mwanza-Kigoma (430)
26. Kigoma-Mpulunga (300)
27. Mpulunga-Yua (230)
28. Yua-Fort Johnson (340)

March
4. Fort Johnson-Beira (450)
6. Beira-Lourenco Marques (530)
8. Lourenco Marques-Durban (320)
29. Durban-Knysna (600)
30. Knysna-Cape Town (300)

April
3. Cape Town-Luderitz (550)
5. Luderitz-Walfish Bay (260)
6. Walfish Bay-Port Alexander (520)
7. Port Alexander-Lobito Bay (260)
8. Lobita Bay-Banana (480)
9. Banana-Libreville (530)
10. Libreville-Bonny (360)
11. Bonny-Lagos (320)
15. Lagos-Takoradi (380)
16. Takoradi-Abidjan (160)
17. Abidjan-Fresco Bay (100)

May
15. Fresco Bay-Freetown (630)
19. Freetown-Bathurst (430)
21. Bathurst-Port Etienne (570)
22. Port Etienne-Las Palmas (570)
26. Las Palmas-Casablanca (650)
27. Casablanca-Gibraltar (250)
28. Gibraltar-Barcelona (630)
29. Barcelona-Bordeaux (370)
31. Bordeaux-Plymouth (460)

AFRICAN SURVEY FLIGHT BANQUET

SIR CHARLES WAKEFIELD, on June 19, at the Savoy Hotel, gave a dinner in honour of Sir Alan and Lady Cobham and the other members of his African Survey Flight. He was supported by Sir Samuel Hoare, Lady Maud Hoare, the Lord Mayor of London, the Lady Mayoress, and a number of distinguished guests. Sir Charles said that of all our pioneers, Sir Alan Cobham was the forerunner, and they welcomed him after the successful completion of a splendid Empire survey. He and Lady Cobham and the other members deserved well of all who looked forward to the rapid progress of aviation within the British Empire. Sir Alan was now the authority upon civil or commercial aviation in Africa, and future services would be based upon his work.

Sir Samuel Hoare then proposed the health of Sir Alan and Lady Cobham and members of the flight. He said that we were on the verge of a great flying-boat expansion, and it was a good sign that at the time when they had had a great flight by the "Singapore" flying-boat in Africa, other flying-boats were exploring in the Far East. Much of the success of a great flight depended upon accurate weather reports. Within the last day they had had the experience of Miss Earhart and Capt. Stultz. Sir Samuel also expressed the

conviction that the survey flight would have direct results on interior air routes. The Colonies on the eastern side of Africa were interested in Imperial lines, and African business men were realising the importance of the air for transport of gold and diamonds. Only recently he received the report of a great mining company, in which it was pointed out the great saving in costs of production that could be obtained by introducing aviation transport of gold. In recent months the Government had been principally engaged in attempting a flying route to India, and when it had been organised the next route to which attention must be given was that between England and Cape Town. He was confident of such a successful organisation, and when the time came they would remember the flight of Sir Alan Cobham as one of the most interesting and important events in its development.

Lady Maud Hoare presented to Lady Cobham a piece of plate, the gift of Sir Charles Wakefield, as a souvenir of the flight, preceded by a charming speech.

Lady Cobham, acknowledging the gift with gratification, said she was glad she had to speak first, as she was going to say much less than her husband. She had the happiest memory of their flight around Africa. It was Lady Maud Hoare's example of accompanying her husband upon his long flight that made her persist in joining her husband on his flight—and she had to thank Lady Maud for that influence.

Sir Alan Cobham, who gave a brilliant summary of his flight, said it had been the greatest utility flight he had ever conducted, and that after his reception that night he felt happy in the thought that they were satisfied with the work they had accomplished in their flight. One thing it had done very emphatically—proved the value of the all-metal machine. In thanking all and sundry who had so materially assisted to the success, particularly those who were with him on the boat, he gave high praise to the magnificent generosity and unselfish help afforded him by Sir Charles Wakefield, and he wished further to bracket with his success Colonel Warwick Wright and Capt. Ward, his manager.

Sir Harry Brittain, in proposing the toast of "Imperial Aviation," expressed the most enthusiastic views upon the future of aviation, especially British, if only the authorities would realise the obligations which their position owed to the furthering of British flying and give it real support in our Dominions and possessions. Already, he said, the Dominions were beginning to develop air services in their own great areas, but the links were long in coming. One ideal plan would be a seaplane service connecting up North and South America, through the West Indian Islands, which ran from British Guiana to the Bahamas. Germany was after it to-day, and when he was in the United States some weeks ago he heard that they had meditations on that route too. But it was a British arc of islands, and should be linked together by British aeroplanes. Finally, he proposed that Sir Alan Cobham should be given Africa to develop for aviation under the Union Jack.

Sir Sefton Brancker, in responding, said he was not himself satisfied with British civil aviation. But it was up to the House of Commons to set the matter right, and in this they looked to Sir Harry Brittain and others to see that they did. But, he said, it was coming along very well. No country with a Sir Charles Wakefield could help being air-minded, and that this was gradually materialising he thought was demonstrated by the fact that recently Imperial Airways, at Glasgow, took up 2,500 joy-riders at 10s. per head. Think of that for Scotland!

"The Guests," proposed by Sir Charles Wakefield, was responded to by Sir Charles Batho, the Lord Mayor of London, followed by Lady Heath, who was responsible for a delightful and earnest speech upon the benefits to be derived by the peoples of the world from the development of aviation.

Lord Riddell also replied; and a tribute to the Chairman by Lord Blanesburgh brought a very brilliant evening to a close.

The members of the flight present included Capt. H. V. Worrall, assistant pilot; Mr. S. R. Bonnett, cinematographer; and Messrs. C. E. Conway, F. Green, H. Nazar and S. Smith, engineers.

Amongst others, besides Lady Wakefield and a very large number of ladies who had accepted invitations, were:—Air Vice-Marshal Sir J. W. Higgins, Lord Montagu of Beaulieu, Sir Francis Newton, High Commissioner for S. Rhodesia, Vicomte Jacques de Sibour, Brig.-Gen. Lord Thomson of Cardington, Air Vice-Marshal Sir V. Vyvyan, Sir Herbert Austin, Sir F. M. Baddeley, Sir Hamar Greenwood, Bart., Sir James Heath, Capt. P. D. Acland, Flight-Lieut. R. R. Bentley, Sqdn.-Commander J. Bird, Maj. H. G. Brackley, Maj. J. S. Buchanan, Air Commodore J. A. Chamier, Maj. S. Cotton, Capt. R. J. Goodman Crouch, Maj. G. P. Bulman, Lieut.-Col. M. O. Darby, Lieut.-Col. I. A. E. Edwards, Brig.-Gen. Festing, Capt. Gladstone, Brig.-Gen. P. R. C. Groves, Maj. F. B. Halford, Maj. H. Hemming, Capt. Garro Jones, Admiral Mark Kerr, Air Vice-Marshal C. L. Lambe, Capt. A. G. Lamplugh, Air Commodore A. M. Longmore, Wing Commander Maycock, Maj. R. H. Mayo, Commander Perrin, Col. The Master of Sempill, Maj. S. V. Sippe, Sir Josiah Stamp, Rear-Admiral Murray Sueter, Maj. H. E. Wimperis, Col. Warwick Wright, Lieut. de-V. Bos, Messrs. A. J. A. Wallace Barr, F. G. L. Bertram, R. Blackburn, L. S. M. Braund, Alan S. Butler, F. Hedges Butler, A. H. R. Fedden, C. Grahame-White, Basil Johnson, W. Lappin, F. Handley-Page, J. Lankester Parker, G. G. Parnall, J. Laurence Pritchard, A. V. Roe, F. E. N. St. Barbe, Oswald Short, F. Sigrist, T. O. M. Sopwith, S. Spooner, G. Holt Thomas, H. T. Vane, etc.

THE ROUND ENGLAND SIDDELEY TROPHY

IN view of the fact that the air race for the Siddeley Trophy, which starts from Hendon Aerodrome on July 20, and finishes at Brooklands Aerodrome on the following day, will be the first light aeroplane contest round England, the following notes on this event may be of interest.

The tour, for which a challenge cup and £250 in prize money have been provided by Mr. J. D. Siddeley, C.B.E., should appeal strongly to the sporting amateur pilots of the lately-formed but very much alive Light Aeroplane Clubs. Although professional pilots and instructors are excluded, the aircraft can be the property of the club or of the members of the club, the only restriction being that the empty weight of each machine must not exceed 1,000 lb. The cost of entering is low, half the £5 entry fee being refunded to all starters.

The course measures approximately 1,050 miles, and is divided into two sections at Glasgow (Renfrew Aerodrome), where the competitors stay the Friday night. On this day's flight the tourists stop for twenty minutes at Norwich (Mousehold Aerodrome), 95 miles, Birmingham (Castle Bromwich Aerodrome), 125 miles, Nottingham (Hucknall Aerodrome), 40 miles, Leeds (Sherburn-in-Elmet Aerodrome), 80 miles, a further 120 miles bringing them to Glasgow for the night and making the first day's total flight one of 520 miles.

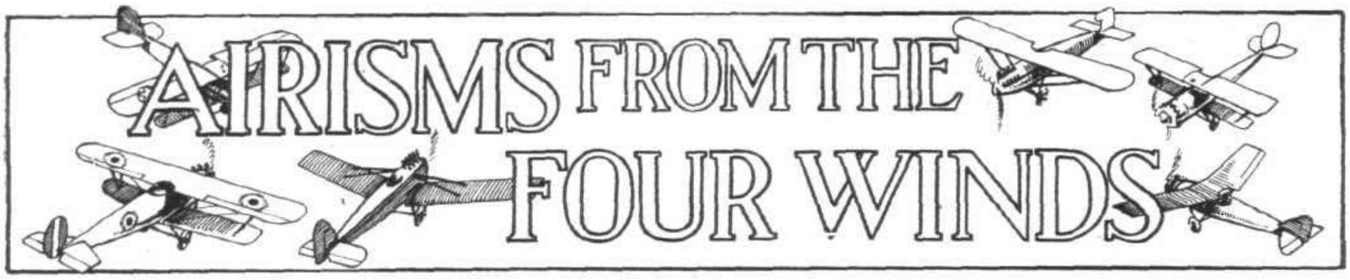
On the Saturday the total distance is 540 miles, the tourists starting from Glasgow and stopping for twenty minutes at Liverpool (Hooton Park), 187 miles, Bristo (Filton Aerodrome), 125 miles, Southampton (Hambl) Aerodrome), 68 miles, and Lympne (Lympne Aerodromee 100 miles, the finish being approximately 60 miles farther on at Brooklands Aerodrome, Weybridge.

In addition to the enforced controls, there is an official turning point at Blackpool (The Tower), where the competitors may be expected to come down low, and where exciting racing may be seen. As each machine will have its racing numbers painted on the sides of its rudder, it will be easy for spectators to recognise the competitors at this turning point.

The tour will be arranged as a handicap. The basis will be the known performance of the various machines, which will be started from Hendon in accordance with the proportion of their handicap allotted for Section 1 of the route. The start from Renfrew Aerodrome, Glasgow, will be in accordance with the proportions of their handicap allotted for Section 2, plus or minus the time gained or lost on their handicap the previous day.

Passengers are permitted, and landing between controls does not disqualify the aircraft, providing that the same machines and engines are used throughout the event.

Entries at ordinary fees close on Friday, June 29, and late entries at double fees on Friday, July 6. The competing aircraft will be officially inspected and verified on Thursday, July19.



The Italia Polar Expedition

GENERAL NOBILE and his airship crew are still adrift in the Arctic regions north-east of Spitzbergen. Capt. Riiser Larsen and Lieut. Holm have been searching in their machines, and General Nobile reported seeing them about five miles away, but unfortunately they did not see him. The General has now given a new position. He is about five miles east of Foyn Island. Major Maddalena, the Italian pilot, also searched in his S55, but without result. A message was sent to General Nobile then, asking him to direct the S55 by wireless if he sights it. Hope has been placed in the latest rescue flight of Capt. R. Amundsen, who left Tromso for Spitzbergen on June 18, in the French seaplane piloted by Capt. Guilbaud, but failed to reach his destination, 500 miles away. As his machine, loaned for the occasion by the French Government, has a long range, it is thought that he decided to continue the flight to the vital regions to avoid delay. A late unconfirmed report states that he had actually landed in a channel amongst the ice near General Nobile's camp.

Duchess of Bedford Delayed

THE Duchess of Bedford, who left Lympne on June 10 in the Fokker-"Jupiter" monoplane "Princess Xenia," piloted by Capt. C. D. Barnard in an attempt to fly to India and back in eight days, has been held up at Bushire. Aleppo was reached on June 11, and on the following day Bushire. On June 13, the flight was continued, but the machine returned shortly after starting with, it is understood, engine trouble. An engineer from Imperial Airways left Basra for Bushire in order to render assistance in setting matters aright, which, it was reported, would take several days.

The Pacific Airmen

CAPT. KINGSFORD-SMITH, with Mr. Ulm, Mr. Warner, and Lieut. Lyon, heroes of the Pacific flight from San Francisco to Sydney, Australia, flew from Sydney to Melbourne in the "Southern Cross" on June 13. They were accompanied by Capt. Kingsford-Smith's mother and Mrs. Ulm. About 50,000 people gave them an enthusiastic welcome at Essendon aerodrome, and they were received by Lord Somers, Governor of Victoria, Mr. Hogan, the State Premier, and Mr. Moull, the Lord Mayor. Col. Brinsmead, the Director of Civil Aviation, was also present. On June 15, the Pacific airmen arrived at Canberra, where they were received by Mr. Bruce, who presented them with the Commonwealth's gift of £5,000. It was announced, on June 17, that H.M. The King had awarded the Air Force Cross to Capt. Kingsford-Smith and Mr. Ulm.

"Bremen" Fliers Return Home

BARON VON HUENEFELD, Capt. Kohl, and Major Fitz-Maurice (Irish Free State Air Force), the heroes of the first East to West Atlantic Flight, arrived at Plymouth on June 16 on their way to Bremen. They were welcomed by the Mayor on board the liner "Columbus." On June 18 they arrived at Bremen, where they naturally received a rousing reception, all ships in the harbour—gaily decorated—blowing their sirens, while numerous types of aircraft flew overhead. First there was an official reception on the "Columbus" by Dr. Brandenburg on behalf of the Reich Government. On the following day, there was a formal reception in the Bremen Rathaus, while on Wednesday they were scheduled to fly to Berlin.

French World Airmen Part

CAPT. COSTES and Lieut. Le Brix, the two French airmen, who flew round the world and were co-operating in an Atlantic flight to New York, have separated. Lieut. Le Brix thought that such a flight should be made in a machine suitable to lead the way for commercial purposes. He has now joined the crew of the Arc-en-Ciel, the machine designed by M. Cousinet, which is to be piloted by M. Drouhin.

French Bombing Squadron in Trouble

ON June 14 a squadron of nine French bombing aeroplanes (21st Regiment) were caught in a violent storm near Paris, and in the forced landings caused thereby five of the machines were damaged. Except for an observer on one machine which crashed just outside Le Bourget, who was killed, all occupants escaped with their lives. Four machines landed without mishap at Le Bourget.

Capt. Courtney's Atlantic Attempt

CAPT. F. T. COURTNEY flew from Piza to Lisbon on June 13 in the Dornier-Napier metal flying boat with which he is attempting an Atlantic flight *via* the Azores.

Danish Air Disaster

A DANISH Naval seaplane, with pilot and two cadets, got out of control while flying over a crowded thoroughfare in Copenhagen on June 13. The occupants jumped or fell out of the machine and were killed, while the machine crashed into a children's playground. Fortunately there were few children there at the time, and only one or two were slightly injured.

"Rocket Plane" Experiments

EXPERIMENTS with a glider equipped with the Opal "Rocket" propulsion, have been carried out at Rositter by Herr Stamer in collaboration with Herr Fritz von Opel. The glider ascended in the usual way, and then the "rockets" were brought into play. The experiment was said to be successful, although the glider nearly caught fire, and as a result a special machine is being constructed.

Air Mail from Sweden

THE first air mail to be flown from Scandinavia to London reached Croydon on June 19. The machine was a Junker's single-engined monoplane, and it carried 500 registered letters, in addition to a large number of ordinary letters and parcels. It flew through the night *via* Oslo, Copenhagen, and Amsterdam, and was due to start from Croydon on the return journey on June 20. It is expected that regular night air mail between Stockholm and London will be operated as a result of that success.

Groenen Killed

SERG. GROENEN, the Belgian pilot who recently established a duration record of 60 hrs. 7 mins. 37 secs., was killed on June 15, while carrying out a practice flight at Tirlemont.

Train *v.* Aeroplane

A NOVEL "stunt" was carried out on June 15 when a simultaneous journey was made from London to Edinburgh by train and aeroplane—the "Flying Scotsman" and the Imperial Airways Armstrong-Whitworth air liner "City of Glasgow" respectively. After breakfast at the Savoy Hotel, the two parties of travellers proceeded to their respective points of departure—King's Cross and Croydon. Train and aeroplane both departed at the same time, 10 a.m., the "City of Glasgow" being piloted by Capt. G. P. Olley, who was accompanied by Mr. J. Birkett, aged 79, a retired L.N.E.R. engine driver, Air Vice-Marshal Sir Vyell Vyvyan and Maj. Brackley. Capt. G. P. Jones, Imperial Airways pilot, was a passenger on the train! The "City of Glasgow" flew *via* the East Coast, and made stops at Bircham, Newton, and Cramlington; it arrived at Turnhouse Aerodrome, Edinburgh, 15 minutes before the "Flying Scotsman" reached Waverley Station.

Aeroplane Clubs in Canada

THE *Daily Telegraph* Montreal correspondent states that the formation of a University Aeroplane Club in each province, with the Federal Government's support, is a project put forward by Colonel Wilfrid Bovey, of McGill University, with the suggestion that Ontario and Quebec shall have two each. An assurance has been given by the Minister of Defence, Colonel Ralston, that the proposal shall have earnest consideration.

Twenty Years Ago!

Extract from "The Auto" (Precursor of "Flight"), June 20, 1908.

"Official Flying Records."—The A.C. de France have officially recorded the following record performances of M. Delagrange with his aeroplane. The records noted are, for distance and time, 3·925 kiloms. in 6 mins. 30 secs. (April 11, 1908); 12·75 kiloms. in 15 mins. $26\frac{1}{5}$ secs. (May 30, 1908.)

The AIRCRAFT ENGINEER

FLIGHT ENGINEERING SECTION

Edited by C. M. POULSEN

June 21, 1928

CONTENTS

EDITORIAL VIEWS

In the previous instalment of his series of articles on Metal Construction Development, Mr. Pollard has dealt mainly with questions of design, discussing problems connected with efficient spar sections allowing a high percentage of the strength of the material used to be developed, forms of rib construction, methods of attachment of different members to each other, and so forth. Interesting as that subject undoubtedly is, we believe that the next few articles will be found by many of our readers even more so. Turning from the problems of design to those of manufacture, Mr. Pollard commences in the present issue a discussion of methods of production. Unfortunately, it has been necessary, owing to lack of space, to divide Mr. Pollard's article, with the result that the portion which appears this month is in the main introductory, and the really instructive section is still to come. That it will be found very instructive we are quite certain, especially to those who are just about to take up the manufacture of components for all-metal aircraft.

Even in the present issue, however, the reader will find much to interest him. A formula is given for determining the radii of the final rolls and dies in order to allow for the right amount of spring-back, and although Mr. Pollard frankly admits that the formula is empirical, and that he can give no mathematical justification for it, we think that at the very least it may be accepted as a good starting point for those with little or no practical experience of forming corrugated sections from flat strip. Doubtless, as experience is gained, modifications will suggest themselves.

On the subject of whether the user should employ strip which has already been heat treated by the manufacturer, or should do his forming of softened strip and heat treat subsequently, Mr. Pollard points out that there appears to be reasons to believe that both systems will have their special advantages, the former method relieving the user of a good deal of work and expense, and the latter being, probably, preferable where a very light structure is required, and where consequently it is desired to use steels with high values of proof stress.

METAL CONSTRUCTION DEVELOPMENT.

By H. J. Pollard, Wh.Ex., A.F.R.Ae.S.

(*Continued from page* 41.)

These articles have in the main had reference to strip construction of the structural members of aeroplanes. It is consequently appropriate that the following notes on workshop practice should begin with a description of one or two methods of forming sections.

Rolling and drawing are common operations, and strip and sheet steel are frequently pressed to shape. An abundance of information is available regarding pressing and allied operations, and the student who has not had the advantage of tool-room experience is referred to the books on press-tool work. One such book to which attention may be drawn is "Die and Press Tool Work," by B. W. Butler and E. J. Hall, published by Cassell and Co., Ltd.

Different and possibly better methods than that given below could no doubt be described by others engaged in metal construction. The method, however, which we will survey briefly, has always given good results, and probably improvements on it will lie in the direction of speed of production. In experimental aircraft, or for that matter in quantity production of such volume as is to be anticipated during the next few years, the method indicated is likely to give the required production. For example, two rolling mills and draw benches will produce from strip all the necessary sections for an output of five or six aeroplanes of average size per week.

The procedure is, in general, to do a certain amount of rolling on every section; in fact, where possible the completed section is formed by rolling. In cases where the finished section is bent to the equivalent of more than a semi-circle as in Fig. 8, major segment, p. 16, or where spring-back necessitates the gap contour of the finishing tools having an arc greater than a semi-circle, the rolls will be followed by a die fixed to the draw bench for the purpose of the second and subsequent operations.

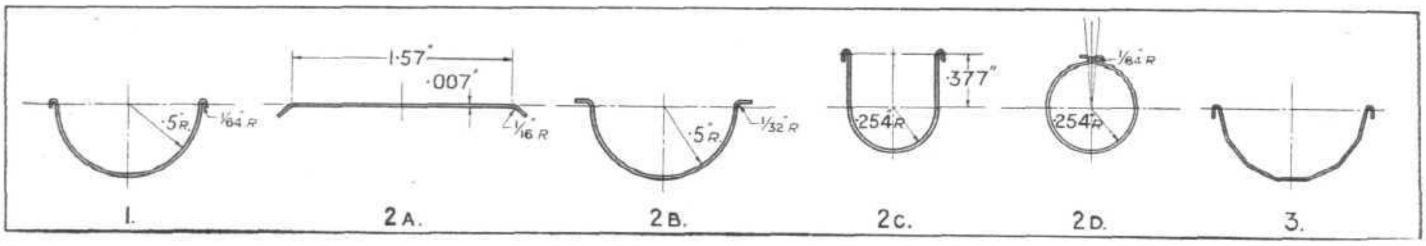
Another method is to work dies in conjunction with rolls on the rolling mill, and so obtain the finished section at one pass; another way is to put the strip through a progressive series of dies, thus obtaining the finished section in one pass. A third method is to fit the draw bench with rolls and dies, and so obtain the finished section at one draw. The last-mentioned way, a combination of rolls and dies on a draw bench, might be the most suitable for mass production. Satisfactory results may be obtained with all the above methods. Whichever way is chosen, it is necessary

that the cause or causes of troubles, if any, should be quickly diagnosed and remedied. If the principles of tool design and the procedure in forming the section are properly applied in every case, it is never a very difficult matter to detect and correct with certainty any irregularities which may arise in production of new and unusual sections. Experience shows also that a final die can usually be either modified or completely re-made much quicker than can a pair of rolls.

What is at present considered to be an excellent method of forming may well be found cumbersome at some time in the future, but changes in a system of working should not be made without ample reasons, as the adoption of new methods invariably causes delays in production.

a substantial reduction of tools over section Fig. 1 in forming from heat-treated strip. In a case where a section as shown in Fig. 1 was required in quantities, however, there would be a very good case for the adoption of the continuous forming and heat-treatment method. For these reasons, and bearing in mind the possibility of the adoption of stainless steel strip in aircraft (which steel of high tensile quality has not in general sufficient ductility for forming into sections in the finished heat-treated state), it appears to be likely that a continuous heat-treatment plant will form part of the equipment of every up-to-date aircraft building factory at some time in the future.

While the writer's arguments are not fortified by actual experience of the process, it would appear that, except in



In connection with this matter of forming I would refer to a remark appearing on page 2 of THE AIRCRAFT ENGINEER, where it was stated in effect that the need for continuous heat-treatment of steel strip was not apparent. The writer omitted to amplify this statement and say, "in the thicknesses of metal hitherto used in strip construction of primary members, and generally in cases where the steel in the heat-treated state has ductility adequate to the demands of the required sections."

Ordinary box spars, etc., have component parts rarely less in thickness than 0·012 in.; more often they have a thickness of 0·015 in., and in these cases two or three pairs of rolls, in the very worst cases four pairs and a die, are all that are necessary to form the strip. The section can be produced at the rate of 20 ft. per minute or so, but as metal construction has developed so has the possible thickness of strip decreased from "thin" 28 G. steel until now, when material 0·005 in. thick and having S.40 properties is being used, it is no longer the case that steel of 28 G. and thereabouts is regarded as very thin. It would appear that with the very thin material now available, the forming of hardened and tempered strip might with advantage give way to a combined

special cases, that soft forming and continuous heat-treatment must be supplementary to the forming of strip which has already been heat-treated, because it must be cheaper to quench flat-strip between flat water-cooled dies than to have special hollow dies for each of the many shaped members which make up an all-metal aeroplane. Again, the steel makers in supplying the whole of the aircraft industry with steel have large quantities of strip for treatment, and with the furnaces continually working the "setting-up" charges, etc., must be less than those which would be incurred by an aircraft building firm where the plant can only be used intermittently. With large quantities of strip on order or in sight the steel maker can instal a large and suitable plant, including long furnaces, which make possible a quick rate of passing. This heat-treatment has to be paid for, and speaking generally it does seem to be a more economic matter for the strip maker to perform this operation than the strip user. Apart from costs it seems more attractive to the strip user to be able to form his sections at speeds varying from 10 ft. to 30 ft. per minute than at speeds of as many inches per minute, with, in special cases, a limit of a few feet per minute. The fact that the important matter of inspection

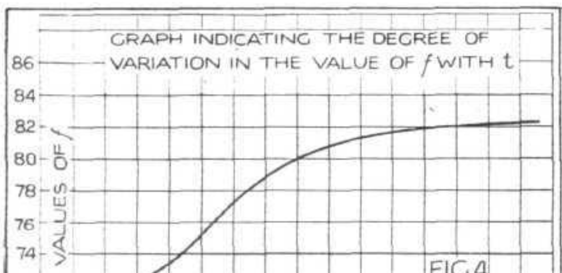


FIG. 4

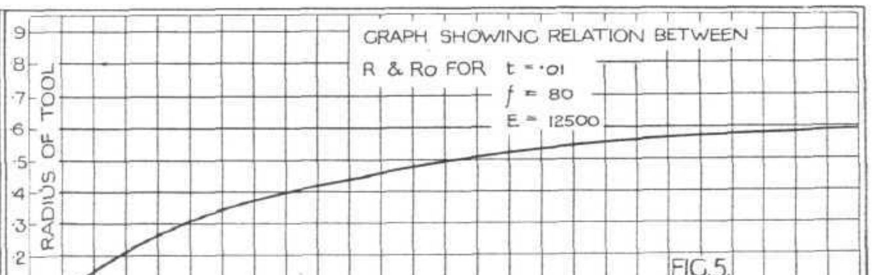


FIG. 5.

method of heat-treatment and forming, the strip being formed cold while in its softest state. For example, suppose a section as shown in Fig. 1 were required, then if the steel ribbon were worked in the heat-treated state, the ultimate tensile strength being 80 tons per sq. in., a series of tools having gap contours as shown in Fig. 2, A, B, C and D, would be needed, but if the strip were supplied in the soft state, the ultimate tensile strength being, say, 30 tons per sq. in., it might be possible to produce the section, Fig. 1, through a single tool or more probably through a pair of dies in tandem at one pass in continuous operation with the furnace. If the furnace were 4 ft. long the forming rate might be 3 ft. or 4ft. per minute, the rate of absorption of heat for complete saturation and subsequent cooling being very rapid for this thin material. A modification to design, however, to Fig. 3 would result in

of the heat-treated strip falls on the steel maker, relieves the user of considerable labour.

These are questions of expediency. From the point of view of getting the lightest possible structure, there is a strong case for forming softened steel strip and heat-treating subsequently. In such a case steel having high values of proof stress, say, 90 tons per sq. in., might be used with advantage, and at the same time sharp radii may where necessary be included in the shape. Such sections could not be formed from strip already heat-treated to the above strength value. It seems likely for these and other reasons that both systems of forming may have their special spheres.

Returning to the question of forming heat-treated high-tensile steel strip by the method of rolling and drawing, the latter being a separate operation, the first step is to settle the

shape of the final rolls or dies in order that the material may spring back to the designed shape. The formula generally used is :—

$$\frac{1}{R_0} - \frac{1}{R} = \frac{2f}{Et}$$

where R_0 = the required radius of the portion of the roll or die gap curve under consideration.

R = the designed radius.

E = Young's modulus of the material.

t = the strip thickness.

and f = a figure dependent on the strength of the material.

The problem of spring-back is of extreme complexity, and the writer can give no mathematical justification for using this formula, but where f is taken as the ultimate tensile strength of the material, a fairly close approximation is obtained to the desired shape. If f is taken either as the elastic limit or the yield point, the material will certainly spring back far too much. As a matter of fact, the value given for f should be varied with the thickness of the material. In cases of very thin strip it is often found that the value of f for exact results exceeds the ultimate tensile strength of the material, also the spring back is governed to an appreciable extent for any particular arc by the shape of the section at the extremities of the arc.

A typical variation in f with thickness is shown in Fig. 4, and in Fig. 5 the relation between R and R_0 is shown graphically for constant values of t and f; it will be noted that for very small radii the spring-back is small, but it is rarely negligible. The designer of the corrugated sections should also be responsible for the manufacture of the tools. Then by careful observation, and by having templates of finished sections made and taking measurements of these, he will quickly collect data enabling him to obtain results with all the precision that is necessary for this work. If the material is oversize, or where considerable variation of strength occurs along the length of a strip, irregularities will ensue in the formed section. The technique of the manufacture of heat-treated steel strip has greatly improved during the last 18 months or two years, so that now trouble due to either of these causes is of rare occurrence. Where reduction in thickness of strip is brought about between rolls, or in a die due to either faulty tools or oversize strip, then bad forming results will be obtained. It is not desired to give the impression that the production of corrugated strip is an extremely difficult or fortuitous matter. On the contrary, it is an operation in metal construction which, given the proper conditions, causes very little trouble.

(To be continued.)

THE APPLICATION OF AERODYNAMIC DATA TO THE STRUCTURAL DESIGN OF AIRCRAFT.

By Frank Radcliffe, B.Sc., A.R.Ae.S.

Fifteen years ago the science of aerodynamics was slowly taking form from the accumulated experiments which had been performed and made public by the various aerodynamical laboratories of the world. In many ways much that had been observed was undigested and the inferences to be gleaned were far from clear. Even so, aircraft had been built during the whole of the war period and many of the designs were certainly extremely successful. But the design of aircraft up to this period of ten years ago was essentially one of development rather than the try-out of new ideas. Experience in past types was the chief factor in the development of a new type, and the general application of scientific principles was viewed with great misgivings.

The past fifteen years appear to the writer to have been years of consolidation in aerodynamic knowledge with the result that, today, as never before, aircraft design is becoming more scientific and less the product of rules of thumb and empirical formulæ.

The scientists of Germany, America, and our own country have been largely responsible for giving shape to these present-day accepted principles and for establishing some degree of ordered experience from an otherwise state of chaos.

The work is by no means completed, but it is believed that the whole conception of aerodynamic theories is now resting on a sure foundation. What is still absent, however, today, which would greatly accelerate the framing of further principles, is co-operation in and an international discussion on theories and views in aerodynamic ideas. It is not by any means easy to see how such a pooling of ideas and a discussion thereon could be effected, and consequently the way it is being done at present is by the assimilation by the keen student of *the other countries' points of view* on certain matters, and the adoption, wherever practicable, of what proves to be the best interpretation of phenomena.

This is a field in which all keen students of aeronautics can actively take a part in research work and help thereby a speedier adoption of the best explanation of aerodynamic principles and phenomena.

The object of this series of articles is to place before the younger members of our design staffs a few applications of aerodynamic data and to make reference to published reports where further information can be gleaned for a deeper study of the subjects referred to. The junior members of our designing staffs are often keen enough to improve their knowledge and experience, but are handicapped from the beginning because they do not know where to begin, what is important and what is not. Technical notes are issued at short intervals by several countries, but the practical man finds the application of the same difficult unless he has first the preliminary guidance. If these notes serve in making R. & M.'s hitherto useless of real practical value, then the writer responsible for these notes will consider his time to have been amply repaid.

The primary object of these articles will be the application of aerodynamic data to structural design and it will be as well to leave for a later article the consideration of the choice of an aerofoil and concentrate entirely on the derivation of lift, drag and moment curves of a given aerofoil for application to stressing the wings, body and tail of an aircraft. These will be derived both graphically and algebraically, as both have their useful application.

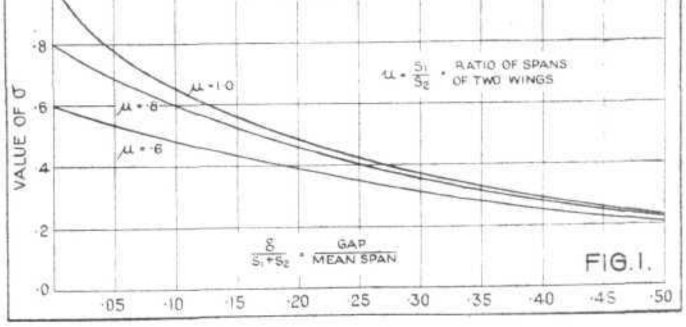


FIG. I.

An examination of aerofoil data will reveal the fact that the lift curve plotted against angle of incidence as base, is for all practical purposes straight from the no lift angle up to about $0 \cdot 9\ k_{L\,max.}$ This being so, the lift curve is conveniently expressed in the form

$$k_L = A\alpha + B \quad \ldots \quad (1)$$

Where α is the angle of incidence in degrees and A and B are constants which can easily be determined.

The k_m curve which in this country expresses the non-dimensional moment coefficient of the wing referred to its leading edge is also conveniently expressed as a linear equation in the form

$$k_m = C\,k_L + D \quad \ldots \quad (2)$$

$$\text{or } k_m = E\alpha + F \quad \ldots \quad (3)$$

where C, D, E and F are constants and can be determined from the lift curve equation.

(In passing, it should be noted that the American practice is to give the moment coefficient about a point in the wing which lies at a quarter of the chord length behind the leading edge of the aerofoil.)

Now for practical purposes, using English moment coefficients, we can immediately calculate the centre of pressure position for a given value of α or k_L by using equations (1) and (2) if we make the near approximation that C.P. $= k_m/k_L$

for $CP = k_m/k_L = C + D/k_L$ ....(4)
from (2)

If, on the other hand, we are using American data, it will possibly be worth while for future work, to convert the $k_{m.25c.}$ into $k_{m\ L.E.}$

Generally, the American reports give the CP curve for the monoplane aerofoil so that

$$k_{m\ L.E.} = CP \times k_L \text{ (approx.)}$$
$$\text{or} \quad = k_{m.25c.} + 0\cdot25\, k_L.$$

be obtained in order to arrive as near the truth as possible with regard to the stressing loads.

The following sources of data may be available :—

(1) Complete model tests combined with separate biplane tests with the fuselage in position.

(2) Biplane test, with separate tests on upper and lower wings with mutual interference effects.

(3) Monoplane aerofoil characteristics.

For special reasons, it may be possible that none of the above is available, or that certain deviations from the standard aerofoil may be desirable.

If this is so, then a theoretical estimation is necessary, which will be treated later under a separate heading.

In sources (1) and/or (2) the aerodynamic assumptions for stressing are simple and straightforward, but if the source of the data is (3), then corrections will be necessary to convert the monoplane characteristics into biplane characteristics.

MONOPLANE CHARACTERISTICS. ASPECT RATIO = 6 — TABLE No. I.

AEROFOIL	α_0°	k_{m_0}	EQUATION TO k_m CURVE	CPF	C.P. AFT	$\frac{dk_L}{d\alpha}$	k_D MIN.	$\frac{L}{D}$ MAX.	k_L MAX.	$\frac{k_L^3 \text{ MAX}}{k_D^2 \text{ MIN}}$	$\left(\frac{k_L^3}{k_D^2}\right)$ MAX.	REFERENCE
R.A.F. 15	$-2\cdot5^\circ$	$-\cdot0175$	$k_m = -\cdot242 k_L - \cdot0175$	·280 C	$\left(\cdot242 + \frac{\cdot0175}{k_L}\right)$ C	·0360	·0051	22·7	575	7320	112	R. & M. 888.
R.A.F. 31	$-6\cdot2^\circ$	$-\cdot0290$	$k_m = -\cdot230 k_L - \cdot0290$	·285 C	$\left(\cdot230 + \frac{\cdot0290}{k_L}\right)$ C	·0366	·0065	19·1	·526	3450	104	R. & M. 928.
No. 64	$-3\cdot5^\circ$	$-\cdot0270$	$k_m = -\cdot231 k_L - \cdot0270$	·275 C	$\left(\cdot231 + \frac{\cdot0270}{k_L}\right)$ C	·0361	·0107	18·1	·613	2010	103	R. & M. 152.
No. 1	$-4\cdot6^\circ$	$-\cdot0486$	$k_m = -\cdot250 k_L - \cdot0486$	·330 C	$\left(\cdot250 + \frac{\cdot0486}{k_L}\right)$ C	·0357	·0082	22·0	·618	3510	113	R. & M. 322.
No. 4	$-6\cdot4^\circ$	$-\cdot0770$	$k_m = -\cdot250 k_L - \cdot0770$	·355 C	$\left(\cdot250 + \frac{\cdot0770}{k_L}\right)$ C	·0360	·0135	17·5	·774	2540	100	R. & M. 322.
GOTT. 426	$-6\cdot9^\circ$	$-\cdot0460$	$k_m = -\cdot255 k_L - \cdot0460$	·335 C	$\left(\cdot255 + \frac{\cdot0460}{k_L}\right)$ C	·0363	·0088	18·0	·650	3540	128	GOTTINGEN REPORT.
CLARK Y	$-5\cdot3^\circ$	$-\cdot0400$	$k_m = -\cdot229 k_L - \cdot0400$	·287 C	$\left(\cdot229 + \frac{\cdot0400}{k_L}\right)$ C	·0361	·0052	22·85	·684	11840	132·5	N.A.C.A. 233.
CLARK YH	$-3\cdot1^\circ$	$-\cdot0150$	$k_m = -\cdot236 k_L - \cdot0150$	·260 C	$\left(\cdot236 + \frac{\cdot0150}{k_L}\right)$ C	·0366	·0057	20·8	·651	8500	132·5	TECH. NOTE. 240. N.A.C.A.
R.A.F. 25	$-3\cdot2^\circ$	$-\cdot0160$	$k_m = -\cdot236 k_L - \cdot0160$	·280 C	$\left(\cdot236 + \frac{\cdot0160}{k_L}\right)$ C	·0363	·0037	23·5	·427	5700	81·0	R. & M. 915.
A.D. 1	$-2\cdot3^\circ$	$-\cdot0290$	$k_m = -\cdot246 k_L - \cdot0290$ UP TO $k_L = \cdot240$; $k_m = -\cdot206 k_L - \cdot0380$ FROM $k_L = \cdot240$	·290 C	$\left(\cdot246 + \frac{\cdot029}{k_L}\right)$ C UP TO $k_L = \cdot24$; $\left(\cdot206 + \frac{\cdot038}{k_L}\right)$ C FROM $k_L = \cdot24$	·0387 $k_L < \cdot27$; ·0284 $k_L > \cdot27$	·0070	21·6	·500	2550	108	R. & M. 943.

As examples, the above have been tabulated in Table 1 for some of the widely used aerofoils in present-day use. Reference is made to the source of the data, so that further investigation can be made if the reader so desires.

The value of C in equation (2) is always about $0\cdot25$, so that for small CP movement it will readily be appreciated why the constant term D should be as small as possible. D, it should be remembered, is the no-lift moment coefficient, *i.e.*, when $k_L = 0$. This value has been tabulated in Table I.

If we assume for an aerofoil that $k_{m_0} = 0\cdot03$ and that k_L for the aerofoil at top speed is $0\cdot1$, then the approximate CP position for top speed conditions would be

$$\left(0\cdot25 + \frac{0\cdot03}{0\cdot1}\right) = 0\cdot55c.$$

This is a C.P. position that would throw heavy loads on the rear spar in flight and still heavier in the terminal nose-dive case.

Thus, if k_{m_0} is greater than $0\cdot03$ the nose-dive conditions will be very severe and the rear frame of the aircraft will need to be stressed for a heavy down load on the tail.

With these introductory remarks, let us now see what corrections may be necessary before the aerodynamic data can be applied to stressing problems.

For the time being, it will be assumed that the aerofoil has been chosen for the particular aircraft under consideration. The detailed characteristics of the wing system have now to

Treating (3) first, the simplest form of biplane will be assumed, *i.e.*, one with the upper and lower wings identical in span, chord, and aerofoil section.

Previous to 1924, data was given with no corrections for the effect of the wind-channel walls on the characteristics.

If this necessary correction has not been applied, it should be applied in the following manner :—

Channel Interference [1].

$$\Delta k_D = 0\cdot274 \frac{S}{C} k_L^2 \quad \text{..................................} \quad (5)$$

$$\Delta \alpha^\circ = 15\cdot7^\circ \frac{S}{C} k_L \quad \text{..................................} \quad (6)$$

where S = area of aerofoil and C = cross-sectional area of the channel.

The constant term in the correction to k_D (*i.e.*, $0\cdot274$) applies to square-section channels only. For a circular channel the constant term becomes $0\cdot25$, and for the N.P.L. Duplex type of channel the constant is $0\cdot274$ when the wing is tested horizontally and $0\cdot524$ when the wing is arranged vertically.

It will be assumed that these corrections have already been made and that the only available tests are on simple monoplanes. The biplane corrections to be made consist chiefly

of interference (including stagger) and aspect ratio on drag, angle of incidence, pitching moments, and maximum lift. It has been found convenient to apply these corrections using k_L as a base. Let the tested aerofoil have aspect ratio $= A_T$

where $A_T = \frac{4s^2}{S}$.

and s = semi-span of the aerofoil

and S = area of the aerofoil;

and let the characteristics be denoted by k_D', α' and k_m'.

Correction to Drag.

If the biplane has the same aspect ratio as the monoplane, then,

$$k_D = k_D' + \frac{2\sigma}{\pi A_T} k_L^2 \quad \text{.................................} \quad (7)$$

A few notes may make this expression a little clearer. The correction term $\frac{2\sigma}{\pi A_T} k_L^2$ is the correction necessary on account of the change in the *induced drag* of the new wing system from the monoplane. It will be remembered that the Prandtl theory of aerofoils [2] states that the drag of any aerofoil is made up of two parts

$$k_D = k_{D_0} + \frac{2}{\pi A_T} k_L^2$$

where k_{D_0} is the drag due to the *profile* of the aerofoil section, which is the value a wing of infinite span would have, and known as the *profile* drag, and $\frac{2}{\pi A_T} k_L^2$ is the drag which is due to the finite shape of the aerofoil, and which is the same for *any* aerofoil of the same geometrical plan form. This is known generally as the *induced* drag.

The term σ in equation (7) is the correction to the induced monoplane drag due to interference effect, and is given in Fig. 1 as a family of curves. It is dependent upon the upper and lower wing span ratios and on the gap.

If the aspect ratio is different from A_T, say A_W, then the correction is modified to read

$$k_D = k_D' + \frac{2}{\pi}\left(\frac{1+\sigma}{A_W} - \frac{1}{A_T}\right) k_L^2 \quad \text{.....................} \quad (8)$$

where, of course, k_D' is the sum of the profile drag and $\frac{2}{\pi A_W} k_L^2$.

Corrections to Angle of Incidence [3].

For an aspect ratio the same as the monoplane test

$$\alpha^\circ = \alpha' + 57\cdot3\left(\frac{2\sigma}{\pi A_T} k_L + \beta\right) \quad \text{.......................} \quad (9)$$

where β is an additional correction due to biplane effect on the effective camber of the wings and is of the form $\beta_0 = \frac{57\cdot3}{8\pi}\left(\frac{c}{h}\right)^2 k_L$ for zero stagger, where c = chord and h = length of line joining L.E. of an equal chord biplane.

(There should be a corresponding correction for this effect on the drag coefficient, but it is very small and so can be neglected.)

Fig. 2 shows β/β_0 plotted against $\phi - \alpha$ where ϕ° is the stagger. It will be sufficiently accurate to take β/β_0 at the mean value of $(\phi - \alpha)$, *i.e.*, at, say, $(\phi - 8^\circ)$. It is convenient to define the stagger of *any* biplane as the angle between the line joining the mid-points of the chords and the normal to the lower wing chord.

For an aspect ratio A_W and a stagger ϕ the total correction for α becomes

$$\alpha^\circ = \alpha' + 57\cdot3\left\{\frac{2}{\pi}\left(\frac{1+\sigma}{A_W} - \frac{1}{A_T}\right)k_L + \frac{1}{8\pi}\left(\frac{c}{h}\right)^2 k_L \frac{\beta}{\beta_{0(\phi-\alpha)}}\right\} \quad (10)$$

The effect of this correction is to decrease the slope of the lift curve on an incidence base by about 12 per cent. for $\frac{\text{chord}}{\text{gap}} = 1$ and $\phi = 0$.

In other words, $\frac{dk_L}{d\alpha}$ is reduced from $0\cdot036$ mono (approx.) to $0\cdot031$ biplane.

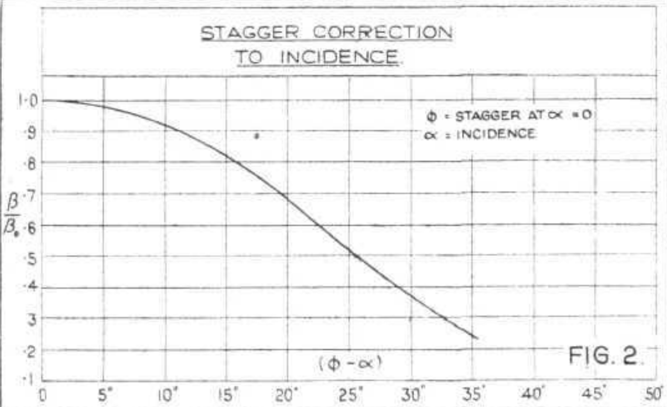


FIG. 2.

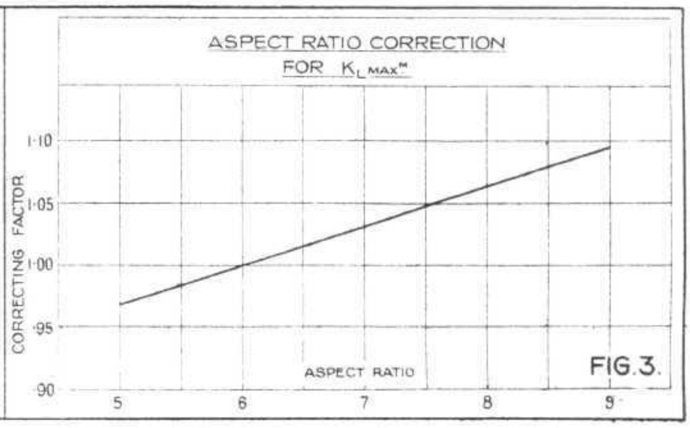


FIG. 3.

Corrections to Pitching Moment.

The main correction, due to the altered effective camber of the aerofoil, will be an alteration in the value of k_m for a given value of k_L. Put in another way, the slope $\frac{dk_m}{dk_L}$ will be decreased and the correction is of the form

$$\left\{1 - \frac{1}{8}\left(\frac{c}{g}\right)^2\right\} \quad \text{..} \quad (11)$$

where g is the gap of the biplane.

The effect of this correction is to reduce the slope by about 12 per cent. for $\frac{\text{chord}}{\text{gap}} = 1$ and $\phi = 0$, *i.e.*, whereas the value for $\frac{dkm}{dk_L}$ mono is approximately $0\cdot25$, the biplane value is generally of the order of $0\cdot22$.

The correction for the effect of stagger, is as yet uncertain, but it is believed to be quite small and so can be neglected for all practical purposes, as the error will then be on the right side from the stress point of view.

Comparative tests on monoplanes and biplanes reveal the fact that there is a slight change in the value of k_{mo} for monoplane and biplane. It is suggested that this may be due to a peculiar scale effect apparent at small values of k_L, so that for full-scale work any change may be neglected.

Corrections to $k_{L\,max}$.

It is a well-known experience that when an aerofoil section is used as a wing system, the full-scale maximum value of its k_L is generally distinctly more than the model value. An indication of this increase is revealed when a model is tested in a wind channel at increasing wind speeds. On the other hand, the writer believes that it is not correct to assign increments to the model of the order of $0\cdot22$. It is suggested that although records of stalling speeds are taken which indicate that the developed $k_{L\,max.}$ for the machine is approaching unity, we must not lose sight of the fact that

assistance is given to the normal wing surface by such agencies as the under side of the aircraft other than wings; the effect of the thrust of the propeller and the cushioning effect of the air between the lower wing and the ground if the results are given for an aircraft flying near the ground.

Corrections to $k_{L\,max.}$ are of an empirical nature, and it is suggested that for obtaining an idea of the probable full scale $k_{L\,max.}$ the following known values in Table II might be referred to and the nearest shape of aerofoil taken as a guide, paying particular regard, not to the external shape of the aerofoil so much as to the shape of the median line of the section.

Corrections are also necessary for aspect ratio, $\frac{\text{gap}}{\text{chord}}$ and stagger, and these are graphically represented in diagrams 3, 4 and 5.

Table II

R.A.F. Aerofoil	Model $k_{L\,max.}$	Full-scale biplane $k_{L\,max.}$
14	0·544 (mono)	0·59
15	0·500 (biplane)	0·54
25	0·427 (mono)	0·46
26	0·461 ,,	0·47
27	0·420 ,,	0·52
28	0·517 ,,	0·54
30	0·458 ,,	0·60
31	0·535 ,,	0·63
32	0·658 ,,	0·66
33	0·620 ,,	0·65
34	0·510 ,,	0·62

Derivation of Individual Upper and Lower Wing Characteristics from Biplane Results

For stressing the wing system of a biplane aircraft it is useful to know the characteristics of the individual wings so that full advantage may be taken of the load distribution to give the most economical structure. The corrections so far applied relate to the biplane as a whole, and it next behoves the stress calculator to deduce the contribution of each wing to the forces in the wing structure.

The theoretical aspect of this section has not been developed to any great extent, so that all that can be recommended is an empirical method based on experimental evidence and further supported by successful application to actual designs. For the equal wing biplane it is suggested that the R.A.F. 15 biplane experiments [4] might be taken as indicative of what is likely to happen. (For unequal wing biplanes a special treatment is suggested later.)

The application of this data is as follows:—

Equal Wing Biplane. (See Fig. 6.)

The mean ratio of k_{Lu}/k_{LL} for the given conditions is taken, and represents the value where $\bar{k}_L$ for the biplane $= \frac{1}{2}\,\bar{k}_{L\,max.}$

We have now the conditions that, if

$$k_{Lu} = x k_{LL}$$

$$x\,k_{LL} + k_{LL} = 2\,\bar{k}_L \text{ since the wings are equal}$$

$$\text{or } k_{LL} = \frac{2\bar{k}_L}{1+x} \quad \ldots\ldots\ldots\ldots\ldots\ldots \quad (12)$$

The stress calculator is interested primarily in the aerofoil characteristics up to the stall, hence for his purpose it will be sufficiently accurate to assume that over this range the lift curve for the lower wing can be represented by a straight line. The errors so introduced will not be great, and there is experimental evidence in support of this procedure.

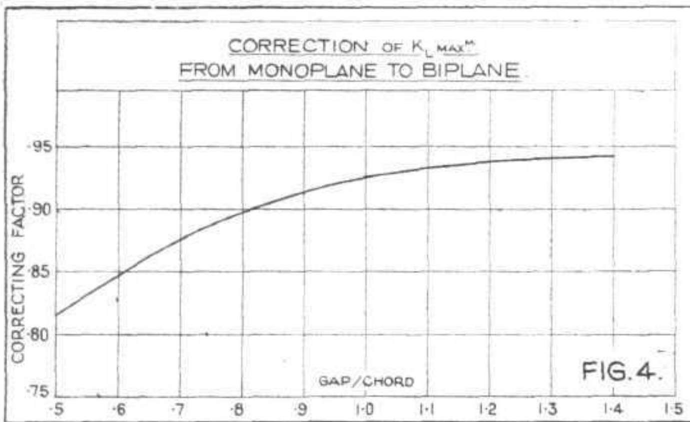


FIG. 4.

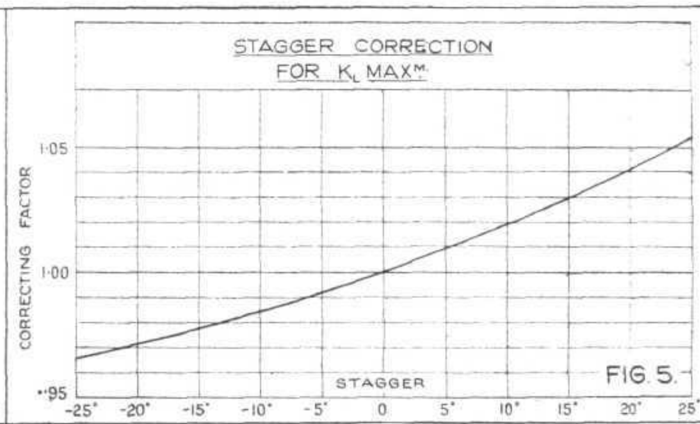


FIG. 5.

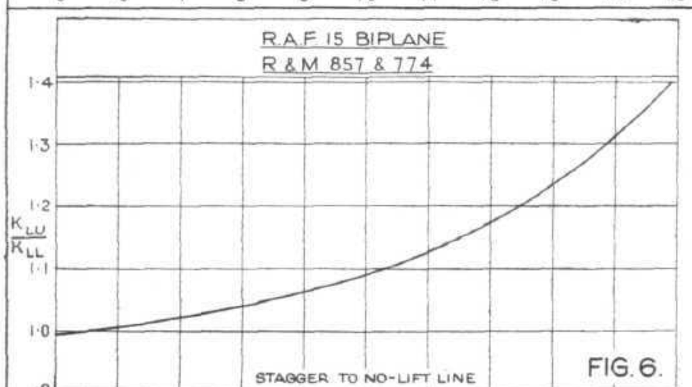


FIG. 6.

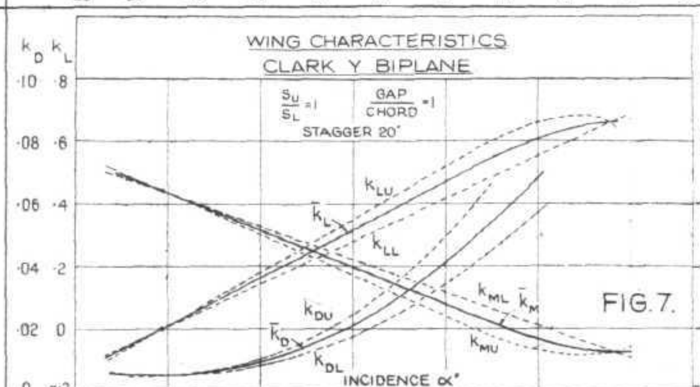


FIG. 7.

In passing, it should be noted that where the trailing edge of an aerofoil has been reflexed the full-scale value of $k_{L\,max.}$ is apt to change erratically, and consequently a conservative estimate should be made. Thick aerofoils, in particular (*i.e.*, when the $\frac{\text{thickness}}{\text{chord}}$ exceeds, say, 0·13), appear to remain either constant for increase in wind speed or else to decrease.

An example in point [6] is the Junkers thick-wing monoplane, where the full-scale test shows a smaller value of $k_{L\,max.}$ which decreases as the value of Vl increases. At the moment full-scale corrections can only be made by discretionary comparison with known aerofoils whose $k_{L\,max.}$ is known.

Having now the biplane lift curve and the lower wing lift curve, it is a simple matter to plot the upper wing lift curve. An example will probably make the above quite clear.

Suppose we have an equal wing biplane of unit $\frac{\text{gap}}{\text{chord}}$ ratio (A = 6) of Clark Y section [5] with a stagger of 20° to the lower wing chord, there being no relative inclination of the chords (wrongly termed *décalage* in this country—which means "stagger"); then for the monoplane we have (see Table I): $k_L = 0·0361\,\alpha + 0·191$ .... (13)

converting (12) to biplane characteristics for the above conditions we get :—

from (7) $k_D = k_D' + \Delta k_D$

where $\Delta k_D = \dfrac{2\sigma}{\pi A_T} k_L^2 = 0\cdot056\, k_L^2$

in this particular example.
From (10) we have

$$\alpha^\circ = \alpha' + 57\cdot3\left(0\cdot056 + \frac{1}{8\pi} \times 0\cdot9397^2 \times 0\cdot89\right) k_L$$

$$= \alpha' + 5\, k_L$$

Now $\dfrac{dk_L}{d\alpha}$ for the mono $= 0\cdot0361$

and for the biplane we shall have

$$\frac{d\bar{k}_L}{d\alpha} = \frac{0\cdot0361}{1 + 5 \times 0\cdot0361} = 0\cdot0306$$

Angle of no-lift for mono and biplane $= -5\cdot3^\circ \left(i.e., \dfrac{0\cdot191}{0\cdot0361}\right)$.

Therefore constant term for the biplane equation is $5\cdot3 \times 0\cdot0306 = 0\cdot162$.

Hence, $\bar{k}_L = 0\cdot0306\alpha + 0\cdot162$.

In correcting $\bar{k}_{L\ max.}$ there will be no full-scale correction necessary as the test on the aerofoil was done in the American high-pressure channel which, it is believed, gives results comparable to those likely to occur in actual full scale.

Hence, from the curves

$$\bar{k}_{L\ max.} = 0\cdot684 \times 0\cdot925 \times 1\cdot041 \times 1\cdot0 = 0\cdot66$$

where $0\cdot925$ is the $\dfrac{\text{gap}}{\text{chord}}$ correction

$1\cdot041$ is the stagger correction

and $1\cdot0$ is the aspect ratio correction.

Our next step will be the deduction of the upper and lower lift curves. From Fig. 6 we see that the mean ratio of the lifts at an angle of stagger of $(20 + 5\cdot3) = 25\cdot3^\circ$ (N.B. —This is the aerodynamic stagger measured from the no-lift attitude) is $1\cdot24$ and this is when $\bar{k}_L = 0\cdot33$.

$\therefore$ from (12) we get

$$k_{LL} = \frac{2 \times 0\cdot33}{2\cdot24} = 0\cdot294\ ;\ \text{or} = 0\cdot892\ \bar{k}_L$$

and $l_{Lu} = 1\cdot24 \times 0\cdot294 = 0\cdot364$; or $= 1\cdot106\ \bar{k}_L$

The results are shown graphically in Fig. 7, but can be expressed algebraically as

$$k_{Lu} = 1\cdot106 \times 0\cdot0306\alpha + 5\cdot3 \times 1\cdot106 \times 0\cdot0306,$$

$$i.e.,\ k_{Lu} = 0\cdot0338\alpha + 0\cdot1795$$

$$\text{and } k_{LL} = 0\cdot892 \times 0\cdot0306\alpha + 5\cdot3 \times 0\cdot892 \times 0\cdot0306$$

$$i.e.,\ k_{LL} = 0\cdot0273\alpha + 0\cdot1448.$$

We next need to find the moment curves for the individual wings. Glauert [3] states that the relationship between the moment and the lift coefficients of a wing should be independent of the multiplane system in which the wing is situated.

That is to say, we can assume $\dfrac{dk_L}{dk_m}$ to remain constant.

Thus, for this biplane system we are considering, the monoplane equation

$$\bar{k}_m = -0\cdot229\ k_L - 0\cdot04$$

becomes, with the applied corrections to convert it to biplane

$$\bar{k}_m = -0\cdot229 \times \tfrac{7}{8}\, k_L - 0\cdot04 \text{ by (11)}$$

$$\text{or } \bar{k}_m = -0\cdot2\ k_L - 0\cdot04$$

This expression can thus be applied to the upper and lower wings and plotted, along with the other characteristics in diagram 8.

Our last data are connected with drag, and here, as the effect on strength calculations is small, the writer suggests that for the biplane the total biplane drag coefficient should be used for the upper and lower wings alike. The errors so introduced should not give rise to any occasion for worry. In the diagram the separate drags are actually plotted and a warning must be added that it is assumed that for a given value of k_L the value of the drag coefficient is assumed the same for upper, lower, or complete biplane wings. In other words, k_D is plotted on a k_L basis.

Diagram 8 thus gives in a graphical form all the data the stress calculator requires for proceeding to the determination of loads in such a wing structure as that indicated above.

Bibliography.

[1] R. & M. 867.—Interference of wind channel walls on the aerodynamic particulars of an aerofoil.—Glauert.
[2] R. & M. 723.—Aerofoil Theory.—Glauert.
[3] R. & M. 901.—Theoretical relationship for a biplane.—Glauert.
[4] R. & M. 997.—Distribution of pressure over a biplane with wings of unequal chord and span.—Irving and Batson.
[5] N.A.C.A. Report 233.—Seven wing Sections at Full Reynolds Number.—Munk and Miller.
[6] R. & M. 945.—Lift and drag of Junkers Monoplane. Comparison of model and full scale.—Clark, &c.

TECHNICAL LITERATURE.

SUMMARIES OF AERONAUTICAL RESEARCH COMMITTEE REPORTS.

These Reports are published by His Majesty's Stationery Office, London, and may be purchased directly from H.M. Stationery Office at the following addresses : Adastral House, Kingsway, W.C. 2; 28, Abingdon Street, London, S.W.1 ; York Street, Manchester ; 1, St. Andrew's Crescent, Cardiff ; or 120, George Street, Edinburgh ; or through any bookseller.

THE ONE-FOOT WIND TUNNEL AT THE NATIONAL PHYSICAL LABORATORY ; INCLUDING PARTICULARS OF CALIBRATION MADE WITH A PITOT TUBE AND VANE ANEMOMETER AT LOW SPEEDS.—By L. F. G. SIMMONS, M.A., A.R.C.Sc., and L. J. JONES. R. & M. No. 1103 (Ae. 280). (9 pages and 16 diagrams.) April, 1927. Price 9*d*. net.

Mainly for testing anemometers and small measuring instruments, a wind tunnel of 1 ft. square section has recently been constructed which is capable of providing a wide range of wind speeds, up to a maximum of 140 ft./sec. Apart from the inclusion of an expansion cone similar to that adopted in the R.A.E. 7-ft. No. 2 tunnel,* the new tunnel is of the customary N.P.L. design.

The low speeds are obtained by the introduction of a diaphragm plate drilled with small holes between the working section and the fan. Two plates are provided ; one to cover a range 0 to 3 ft./sec., the other from 2 to 14 ft./sec.

Measurements of wind speed were made at a number of points in the working section with a Pitot tube, over the range 20 to 140 ft./sec. For speeds below 20 ft./sec. other methods had to be employed ; these are described at length in the report.

Although no distributor was fitted, it was found that the airflow, as regards distribution and steadiness, compares favourably with that of other tunnels. At low speeds the difference of pressure between the two sides of the diaphragm plate is used to indicate the air speed. In addition to establishing the relation between this pressure difference and the speed, it was shown that the Pitot factor does not vary seriously from 0·5 over the range covered by the experiments. Scale effects were shown to exist at low speeds for other pressure measurements made during the course of the investigation.

Observations of the rate of flow of smoke introduced into the tunnel, showed the presence of a critical speed in the neighbourhood of 0·7 ft./sec. ; this figure agrees with calculations based on data derived from the flow of water in a small rectangular channel.

* R. & M. 574.—Report on tests of a model of the proposed No. 2 7 ft. wind tunnel at the R.A.E.—Sandison and Alford.

FURTHER EXPERIMENTS ON A MODEL OF THE "BANTAM" AEROPLANE WITH SPECIAL REFERENCE TO THE "FLAT" SPIN.—By H. B. IRVING, B.Sc., and A. S. BATSON, B.Sc. R. & M. No. 1107 (Ae. 284). (26 pages and 12 diagrams.) June, 1927. Price 1*s*. 3*d*. net.

The present experiments bear chiefly on the manœuvre known as the "flat" spin, and are a continuation of experiments on "Bantam," described in R. & M. 976.*

The incidence range of previous experiments has been extended from about 40° to nearly 90°, and measurements made of the three moments due to rolling about the wind axis through the centre of gravity of the aeroplane. The contribution of the tail organs to these moments has been investigated in some detail. *The effect of rolling on drag has been measured for the complete model and for body with tail.*

* R. & M. 976. Some experiments on a model of a B.A.T. "Bantam" Aeroplane with special reference to spinning accidents. Parts I and II.—Irving and Batson, Townend and Kirkup.

The range of *auto-rotation* of the "Bantam" complete model extends from just below 20° to slightly over 80° incidence. At certain incidences and speeds of rotation, the addition of fin and rudder tends to *increase* the rate of rotation, and removal of the wings and undercarriage from the model were found to have little effect on this "reversal" in fin and rudder. Removal of the tailplane in stages indicated that the reversal was due to shielding of fin and rudder by the tailplane.

Fin and rudder on the body gave practically the same results as fin and rudder alone.

Rudder control at 60° incidence for complete model is half the rudder control for fin and rudder alone for moderate speeds of rotation. At higher speeds of rotation, the curves of rudder control for these two cases cross and the rudder control for fin and rudder alone becomes less than for the complete model.

The drag of complete model and of body with tail is increased by rolling. Calculations of the variation of drag of wings with rolling, based on strip theory, give only a very rough indication of the actual variation.

Considerations of longitudinal trim indicate that the incidence of present-day machines in a spin cannot attain values approaching close to 90°. The flattening of the pitching moment curve, however, and the possibility of reversal in fin and rudder effect throw additional light on the process by which a slow spin at an incidence not greatly beyond the stall may develop into a fast one at very high incidence.

LIFT and DRAG of THREE MODEL AEROPLANES. COMPARATIVE TESTS IN ATMOSPHERIC AND VARIABLE DENSITY WIND TUNNELS AT THE SAME REYNOLDS NUMBER.—By H. C. H. Townend, B.Sc. R. & M. No. 1122 (Ae. 295). (6 pages and 6 diagrams.) June, 1927. Price 6*d*. net.

Three model aeroplanes, previously tested in a variable density tunnel at various pressures, have been re-tested in an atmospheric tunnel to ascertain to what extent the results obtained in the two tunnels agree at the same Reynolds number, particularly with respect to maximum lift.

Lift, drag and pitching moment were measured on all the models (without tail units) from zero to maximum lift. The results from the Variable Density Tunnel* are compared with those obtained in the atmospheric tunnel, and also with a few full-scale results obtained from other sources.

The results, regarded as a comparison between experiments in two different tunnels, are in excellent agreement. The ability of the Variable Density Tunnel to yield results applicable to full scale with fair accuracy is also apparent by comparison of the results with the flight tests made by the Royal Aircraft Establishment.†

* N.A.C.A.—Tests on models of three British aeroplanes in the Variable Density Wind Tunnel.—G. J. Higgins, W. S. Diehl, and G. L. Detoe. (T. 2438.)

† R. & M. 763.—Lift and Drag of B.E.2e with R.A.F. 18 wings. Comparison of full scale and model results.—H. M. Garner and F. B. Bradfield.

R. & M. 859.—Lift and drag of the Bristol Fighter with wings of three Aspect Ratios. Aerodynamics Staff, R.A.E. (The wings were of R.A.F. 15 section.)

R. & M. 1052.—Full scale and model measurements of lift and drag of Bristol Fighter with R.A.F. 30 wings.—A. E. Woodward Nutt, R. G. Harris and L. E. Caygill.

WIND TUNNEL TESTS WITH HIGH TIP SPEED AIRSCREWS. THE CHARACTERISTICS OF BI-CONVEX NO. 2 AEROFOIL SECTION AT HIGH SPEEDS.—By G. P. Douglas, D.Sc., and W. G. A. Perring, R.N.C. Presented by Director of Scientific Research, Air Ministry. R. & M. No. 1123 (Ae. 296). (10 pages and 5 diagrams). September, 1927. Price 9*d*. net.

The present experiments continue the investigations into the effect of tip speed on airscrew performance described in R. & M. 1086* and R. & M. 1091.†

Two airscrews having bi-convex No. 2 blade section have been tested under identical conditions to the R.A.F. 31A and bi-convex airscrews described in the previous reports. The airscrews had bi-convex blade sections with sharp leading and trailing edges, and with the maximum thickness (10 per cent. C.) at the mid-point of the chord. The tests were carried out at tip speeds up to 1·3 times the velocity of sound, and the results have been analysed to show the variation of lift and drag with speed.

The general results are similar to those of the R.A.F. 31A and bi-convex section previously tested, but the bi-convex No. 2 section is better than the thicker and less cambered original bi-convex section at all speeds, and is better than the R.A.F. 31A section at and above 0·8 of the speed of sound.

The results for the present section and previous sections tested are compared with those for a conventional airscrew section in report R. & M. 1124.‡

Airscrews of conventional blade section (aerofoils No. 3 and 4, R. & M. 322) have also been tested.§

* R. & M. 1086. Wind Tunnel Tests with High-Speed Airscrews. The characteristics of the Aerofoil Section, R.A.F. 31A, at high speeds.—G. P. Douglas and W. G. A. Perring.

† R. & M. 1091. Wind Tunnel Tests with High Tip Speed Airscrews.—G. P. Douglas and W. G. A. Perring.

‡ Wind Tunnel Tests with High Tip Speed Airscrews. The characteristics of a Conventional Airscrew Section Aerofoil R. & M. 322, No. 3, at High Speeds.—G. P. Douglas and W. G. A. Perring.

§ R. & M. 1124.

WIND TUNNEL TESTS WITH HIGH TIP SPEED AIRSCREWS. THE CHARACTERISTICS OF A CONVENTIONAL AIRSCREW SECTION, AEROFOIL R. & M. 322, NO. 3, AT HIGH SPEEDS.—By G. P. Douglas, D.Sc., and W. G. A. Perring, R.N.C. Presented by the Director of Scientific Research, Air Ministry. R. &. M. No. 1124 (Ae. 297). (14 pages and 8 diagrams). September, 1927. Price 9*d*. net.

The present experiments continue the investigation into the effect of tip speed on airscrew performance described in Reports and Memoranda Nos. 1086* and 1091†.

A variable pitch airscrew having a conventional type of airscrew blade section has been tested under the same conditions as the R.A.F. 31A airscrews and the bi-convex airscrews described in the previous reports. The present section had a maximum thickness of 10 per cent. C., and was No. 3 of the series of sections contained in R. & M. 322. Tests have been carried out for three pitch settings at tip speeds up to 1·3 times the velocity of sound, and the results have been analysed to show the variation of lift and drag with speed.

The general results are very similar to those of the R.A.F.31A and bi-convex sections previously tested. The lift and drag curves are fairly well established for speeds up to 0·7A except at high lift coefficients. At high lift coefficients and for speeds above 0·7, owing to the nature of the flow becoming critical, the characteristics of the section appear to depend upon the VL/ν value of the test as well as upon the ratio of the speed to the speed of sound.

For speeds up to 0·8 of the speed of sound the conventional type of section is practically as good as any section previously tested and at and above 0·9A it appears to be slightly inferior to the bi-convex No. 2 section. The importance of the Reynolds' number of the element under test possibly affords an explanation of the good lift results obtained in the original experiments (R. & M. 884)‡ with similar, but not identical, sections.

It is proposed to extend the tests on this blade section using an airscrew of increased blade width to give a higher Reynolds number.

Two airscrews are now being made up to test R.A.F. 27 and R.A.F. 28 aerofoils as blade sections.

* Wind Tunnel Tests with High-Speed Airscrews. The Characteristics of the Aerofoil Section, R.A.F. 31A, at High Speeds.—G. P. Douglas and W. G. A. Perring.

† Wind Tunnel Tests with High Tip Speed Airscrews.—G. P. Douglas and W. G. A. Perring.

‡ The Effects of Tip Speed on Airscrew Performance.—R. McKinnon Wood and G. P. Douglas.

AMERICAN NATIONAL ADVISORY COMMITTEE REPORTS.

The National Advisory Committee for Aeronautics in the United States of America corresponds to our own Aeronautical Research Committee. Two distinct classes of reports are issued, the first being known as *Technical Reports*. These Technical Reports are printed, and are illustrated by photographs and/or drawings. The second class are known as *Technical Notes*, and are issued in mimeographed form so as to enable them to be rapidly distributed to a somewhat smaller, but directly interested, circle of readers. Copies of the Reports and Notes may be obtained from the Superintendent of Documents, Government Printing Office, Washington, D.C., U.S.A.

T.R. NO. 281. "THE EFFECTS OF FUEL AND CYLINDER GAS DENSITIES ON THE CHARACTERISTICS OF FUEL SPRAYS FOR OIL ENGINES." By William F. Joachim and Edward G. Beardsley, N.A.C.A.

This investigation was conducted at the Langley Memorial Aeronautical Laboratory as a part of a general research on fuel-injection engines for aircraft. The purpose of the investigation was to determine the effects of fuel and cylinder gas densities upon several characteristics of fuel sprays for oil engines.

The start, growth, and cut-off of single fuel sprays produced by automatic injection valves were recorded on photographic film by means of special high-speed motion-picture apparatus. This equipment, which has been described in previous reports, is capable of taking 25 consecutive pictures of the moving spray at the rate of 4,000 per second.

The penetrations of the fuel sprays increased and the cone angles and relative distributions decreased with increase in the specific gravity of the fuel. The density of the gas into which the fuel sprays were injected controlled their penetration. This was the only characteristic of the chamber gas that had a measurable effect upon the fuel sprays. Application of fuel-spray penetration data to the case of an engine, in which the pressure is rising during injection, indicated that fuel sprays may penetrate considerably farther than when injected into a gas at a density equal to that of the gas in an engine cylinder at top centre.

T.R. NO. 282. "THE PERFORMANCE OF SEVERAL COMBUSTION CHAMBERS DESIGNED FOR AIRCRAFT OIL ENGINES." By William F. Joachim and Carlton Kemper, N.A.C.A.

Several investigations have been made on single-cylinder test engines at the Langley Memorial Aeronautical Laboratory to determine the performance characteristics of four types of combustion chambers for aircraft oil engines. Two of the combustion chambers studied were bulb-type precombustion chambers, the connecting orifice of one having been designed to produce high turbulence by tangential air flow in both the precombustion chamber and the cylinder. The other two were integral combustion chambers, one being dome-shaped and the other pent-roof shaped. The injection systems used included cam and eccentric-driven fuel pumps and diaphragm and spring-loaded fuel-injection valves. A diaphragm-type maximum cylinder pressure indicator has been used in part of these investigations with which the cylinder pressures were controlled to definite values. The performance of the engines when equipped with each of the combustion chambers is discussed. The data presented show the performance for speeds from 600 to 1,800 r.p.m.

The results obtained indicate that aircraft-type oil engines, with suitably designed combustion chambers and fuel-injection systems may be operated at speeds around 1,800 r.p.m. without encountering excessive explosion pressures. At a speed of 1,600 r.p.m., and with a fuel quantity giving 15 per cent. excess air in the cylinder, a maximum indicated mean effective pressure of 119 lbs. per square inch was obtained with a fuel consumption of 0·43 lbs. per indicated horse-power per hour. The maximum cylinder pressure was 740 lbs. per square inch. A minimum fuel consumption of 0·26 lbs. per indicated horse-power per hour, at an indicated mean effective pressure of 52 lbs. per square inch and 1,600 r.p.m. was obtained with a cylinder head having a bulb-type precombustion chamber. The maximum cylinder pressure was 560 lbs. per square inch.

It is concluded that an increase in specific power output of the high-speed aircraft oil engine depends upon the ability to obtain higher mean effective pressures, and an improvement in the mechanical efficiency of the engine. The best performance for the tests reported was obtained with a bulb-type combustion chamber designed to give a high degree of turbulence within the bulb and cylinder.

THE NAPIER SERIES XI ENGINE

Normal Power 530 B.H.P. at 2,350 R.P.M.

The new Napier aero engine, Series XI, is a development of the world-famous "Lion" Series V, which has had such outstanding success, not only in the British Royal Air Force and in commercial aviation by Imperial Airways, but also in the air services of most foreign countries.

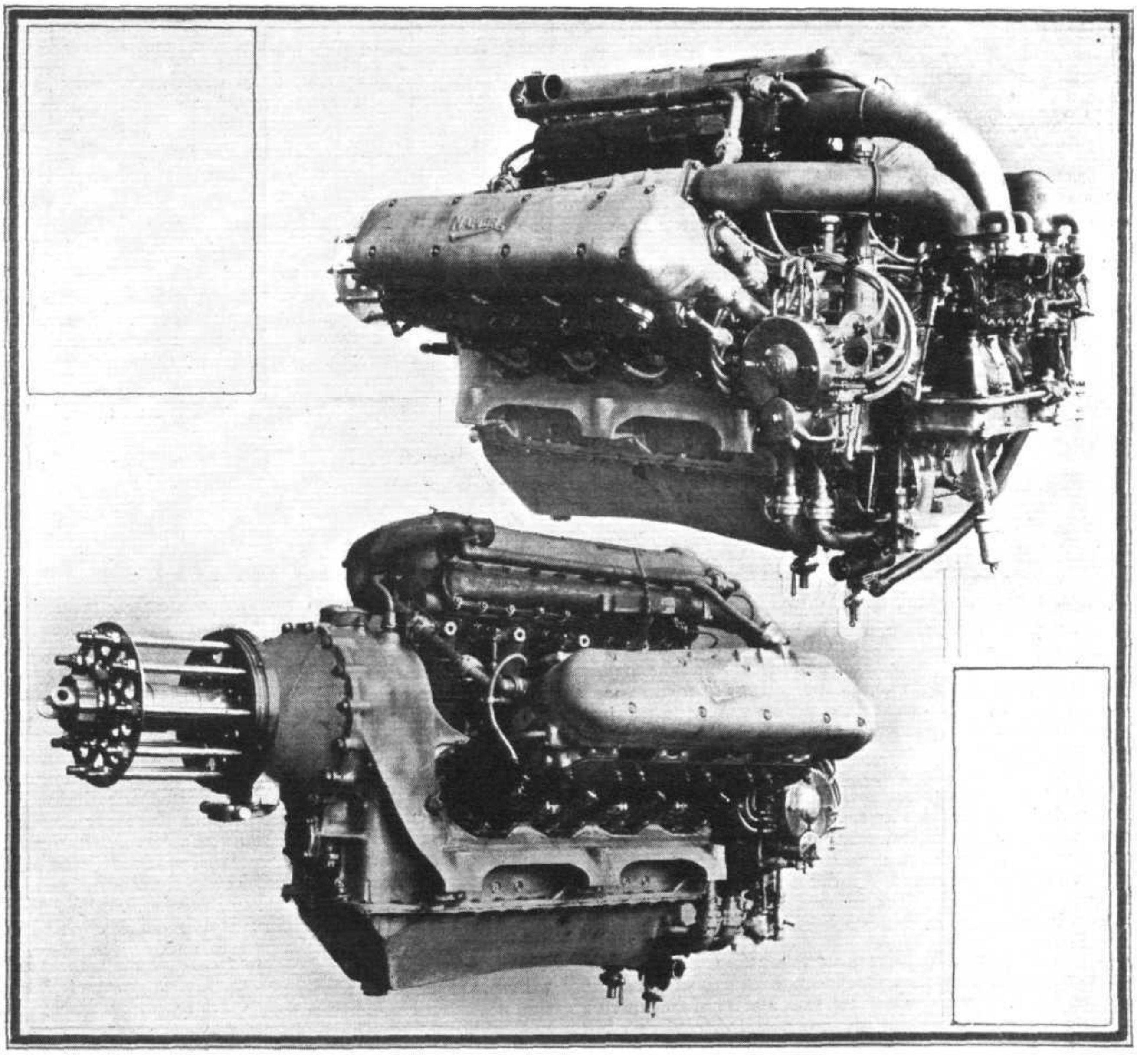
The Series XI is, however, something more than the logical development of the "Lion V." In its design use has been made of the results of experience in racing engines such as those fitted in Schneider Trophy machines for several years. For instance, it will be noted from the views of the new engine that accessories such as carburettors, &c., have been mounted at the back of the engine, where they are out of the way and masked by the cylinders, so that a good streamline cowling is much more easily provided.

The main improvement obtained, as compared with the "Lion V," is, however, the increased power output. With a compression ratio of 6 to 1, this engine develops 530 b.h.p. at 2,350 r.p.m., while its power at maximum permissible speed (2,585 r.p.m.) is 570 b.h.p.

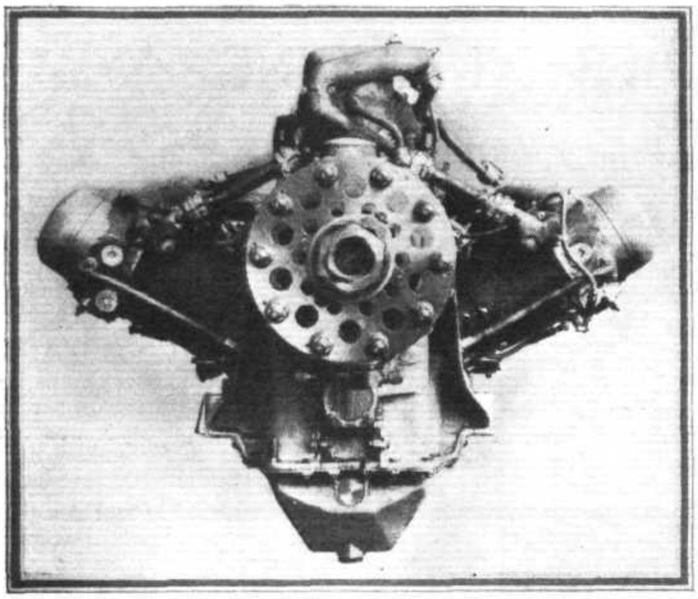
The Napier Series XI has successfully passed the Air Ministry's 100 hours' type tests, including ten non-stop runs of 10 hours' duration each at 2,350 r.p.m., and at an average power of 477 b.h.p. The engine was then opened up to 2,715 r.p.m., and was run for one hour at this speed. A further hour at 2,585 r.p.m. was run at full throttle, the engine developing approximately 573 b.h.p.

While the Napier Series XI is a relatively new engine, it has already been installed and flown in quite a number of different types of British aircraft. For example, it was the Series XI which was fitted in the Fairey III F machines which flew from Cairo to Cape Town and back this year. The de Havilland "Hound," on which Captain Hubert Broad recently established world's records for speed with useful loads of 500 kg. and 1,000 kg., was similarly fitted, while other types that have been equipped with the Napier Series XI are the Handley Page "Harrow," the Blackburn "Ripon," and the Avro "Buffalo."

Following is a brief specification of the Napier Series XI :—

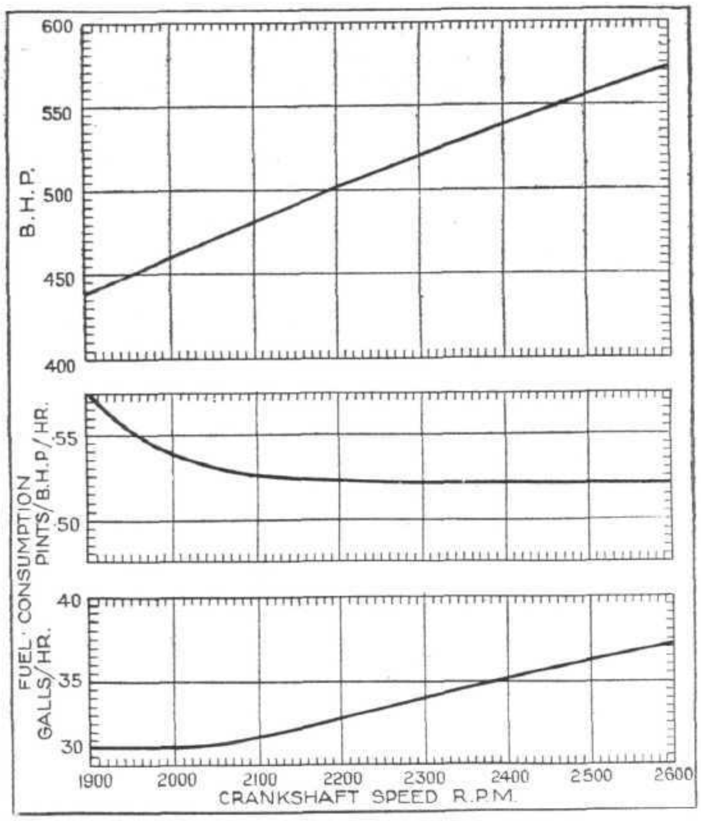


THE NAPIER SERIES XI ENGINE : Three-quarter front and three-quarter rear views. The results of racing experience are traceable in this engine. For one thing, the grouping of accessories at the back resembles that of the Schneider type racing engine.



THE NAPIER SERIES XI AERO ENGINE: Front view.

Number and arrangement of cylinders: 12, in three blocks of four each, 60 deg.
Cooling: Water.
Bore: $5\frac{1}{2}$ ins. (140 mm.).
Stroke: $5\frac{1}{8}$ ins. (130 mm.).
Power: Normal rating: 530 b.h.p. at 2,350 r.p.m. Max. permissible: 570 b.h.p. at 2,585 r.p.m.
Weight: 995 lb. (452 kg.), complete with airscrew boss reduction gear, hand starting gear less magneto.
Specific Weight: On rated power 1·879 lb./h.p. On average power at maximum speed, 1·745 lb./h.p.
Length o.a.: 5 ft. 1 in. (1·55 m.).
Width o.a.: 3 ft. 6 in. (1·067 m.).
Height o.a.: 3 ft. 3 in. (0·99 m.).



THE NAPIER SERIES XI AERO ENGINE: Full throttle power and consumption curves. Compression ratio 6 to 1; fuel 72 per cent. British standard aviation spirit and 28 per cent. Benzole.

Fuel Consumption: Average, at full load: 0·50 lb./h.p./hour (0·227 kg./CV./h.).
Oil Consumption: Average, 0·0235 lb./h.p./hour (0·0168 kg./CV/h.).

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THE U.S. COMBINED AIR AND RAIL VENTURE

IN our issue for May 17 we made brief reference to a new combined air and rail venture that has just been launched in America. We now give some fuller particulars regarding the scheme. The new company, with a capital of \$5,000,000 (£1,000,000), is known as Transcontinental Air Transport Incorporated, and has been organised by two of the leading aircraft companies in the United States and two of the largest railroad systems.

The initial route, covering a distance of over 3,000 miles, will extend from the Atlantic to the Pacific coasts, with New York and Los Angeles as terminal points. Sponsoring the new company are representatives of the Pennsylvania and the Atchison, Topeka and Santa Fé railway companies, together with the Curtiss and Wright aircraft manufacturing companies. The project has in addition the backing of a powerful banking group headed by Messrs. Blair and Co., of New York.

By means of this new service of combined air and rail routes, which is being organised right away, west-bound passengers leaving New York in the evening will arrive in Los Angeles on the second afternoon following—two full days being thus cut from the present fastest time of four days required for the journey.

The rail and air stages of the journey will be divided as follows: (1) Pennsylvania Railway overnight to a point near Columbus, Ohio; breakfast. (2) Aeroplane to St. Louis; luncheon. (3) Atchison, Topeka and Santa Fé Railway overnight to a point in New Mexico. (5) Aeroplane to Los Angeles.

Specially-constructed three-engined aeroplanes, each carrying 14 passengers, will be employed, and will be equipped with every form of safety device considered necessary, as well as with wireless and a steward service. Landing fields are to be laid out with elaborate arrangements for the convenience and comfort of passengers.

The President of the new company is Mr. C. M. Keys, who is also President of the Curtiss Aeroplane and Motor Co., Inc., and Chairman of the Executive Committee of the National Air Transport. The capital (\$5,000,000), in shares of no par value, has already been subscribed in cash by the sponsors of the project, among these being Blair and Co. (New York bankers), Pennsylvania Railroad, National Air Transport, C. M. Keys and Co., J. C. Willson and Co., Haydon Stone and Co., and William H. Vanderbilt. The first Board of Directors will include Mr. Harold Bixby and Mr. Harry B. Knight, who were prominent among the backers of Lindbergh's New York-Paris flight. Other Directors are Mr. W. B. Mayo (Chief Engineer of the Ford Motor Co.), Mr. J. Cheever (Blair Co.), Mr. Howard E. Coffin (N.A.T. of Detroit), Mr. Chas. L. Lawrence (Wright Aeronautical Corp.), etc.

Col. Chas. Lindbergh has also joined the company as Chairman of the Technical Committee, which will be concerned with the choice of equipment, landing fields, general service, etc.

The Transcontinental Air Transport plans later to inaugurate several auxiliary air services, which will feed the main east-to-west artery, and it hopes eventually to link up with a combined air and rail service all the important cities in the United States. The first auxiliary service, it is stated, will be a branch line from Chicago to St. Louis and Kansas City.

The growth of enthusiasm throughout America for air transport—stimulated recently by the success of the transatlantic flights—has been largely responsible for the materialisation of the scheme, which is a practical business venture, backed by enormous resources and directed by business men. It is stated that the decision to inaugurate the service was only reached after months of study, and that data obtained from the London-Paris service had provided the foundation for the company's plans. There is every probability that the action of the Pennsylvania and Santa Fé railway companies in using aviation as an ally will probably be followed shortly along similar lines by other important American railways.

PRIVATE FLYING

A Section of FLIGHT in the Interests of the Private Owner, Owner-Pilot, and Club Member

CZECHOSLOVAKIAN LIGHT 'PLANE RECORD

MAJOR VICHEREK, Chief of the test-squadron of the Institution for Military Aeronautical Studies, established a world's long-distance record for single-seater light aeroplanes on June 6-7. He flew 1,530 miles (2,500 kms.) in nearly 20 hours, in a low-winged Avia BH II machine fitted with a Walter 60 h.p. engine. It was with this same machine and engine that the old record was put up by another Czechoslovakian pilot, Capt. Cerný, when, on September 8, 1927, he flew 1,064·9 miles (1,740 kms.) in 12 hrs. 50 mins.

Maj. Vicherek started from the Kbely aerodrome, Praha, at 7 a.m., on June 6. His machine was loaded with 705·6 lbs. (320 kgs.) of petrol, and 66·05 lbs. (30 kgs.) of oil, whilst the total weight of the machine, including the pilot, was 1,697·85 lbs. (770 kgs.). The power loading was 41·64 lbs. (12·9 kgs.), and wing loading 132·3 lbs. (60 kgs.) per one square metre. After a run of about 383 yards, the machine took off and climbed to 790 ft. in 3 mins. Then it began to cover the triangular course between Praha-Benatky-Ríp-Praha, appearing at each turning point every 48 mins., thus covering 62·76 effective miles (101 kms.) at an average speed of 74·57 m.p.h. (120 kms.) At the eighteenth lap, the old record by Capt. Cerný was beaten and the new enthusiastically heralded by the representatives of the Avia and Walter works. It looked then as though the pilot would beat the record appreciably. Eventually, a fault in the petrol system arose, after the twenty-fifth lap, and the pilot landed at 3 a.m., with 132·3 lbs. of petrol left, whilst he estimated that another 93 miles (500 kms.) could have been covered.

This Avia monplane has won many honours for its country, and the Walter 60 h.p. engine has shared in them. The petrol consumption for the record was 5,253·3 lbs. of petrol (260 kgs.), and 19·85 lbs. (9 kgs.) of oil.

The manufacturers, J. Walter & Co., Ltd., of Praha, export the type to many countries, and we understand that they had an order for 500 of their 120 h.p. engines from the American company, Spartan Aircraft. It is anticipated too, that a similar number will be ordered every year for the next five years.

Maj. Vicherek's engine had " Jiskra " plugs.

An Avia BH 29 (Walter 60 h.p.) engine recently visited this country in the course of a European tour. The pilot was Capt. Hamsik.

CZECHOSLOVAKIAN RECORD : This is Maj. Vicherek, the Czechoslovakian test pilot, who set up the record of 20 hours' continuous flying on the low-winged monoplane Avia BH II (Walter 60 h.p. engine).

LIGHT 'PLANE CLUBS

London Aeroplane Club, Stag Lane, Edgware. Sec., H. E. Perrin, Clifford Street, London, W.1.

Bristol and Wessex Aeroplane Club Filton, Gloucester. Secretary, Capt. C. F. G. Crawford, Filton Aerodrome, Patchway.

Hampshire Aero Club, Hamble, Southampton. Secretary, H. J. Harrington, Hamble, Southampton.

Lancashire Aero Club, Woodford, Lancs. Secretary, C. J. Wood Oakfield, Dukinfield, near Manchester.

Midland Aero Club, Castle Bromwich, Birmingham. Secretary, Maj. Gilbert Dennison, 22, Villa Road, Handsworth, Birmingham.

Newcastle-on-Tyne Aero Club, Cramlington, Northumberland. Secretary, A. H.Bell, c/o The Club.

Norfolk and Norwich Aero Club, Mousehold, Norwich. Manager, F. Gough, The Aerodrome, Mousehold, Norwich.

Nottingham Aero Club, Hucknall, Nottingham, Hon. Secretary, Cecil R. Sands, A.C.A., Imperial Buildings, Victoria Street, Nottingham.

The Scottish Flying Club, 101, St. Vincent Street, Glasgow, Secretary, Harry W. Smith.

Southern Aero Club, Shoreham, Sussex. Secretary, C. A. Boucher, Shoreham Aerodrome, Sussex.

Suffolk Aeroplane Club, Ipswich. Secretary, Maj. P. L. Holmes, The Aerodrome, Hadleigh, Suffolk.

Yorkshire Aeroplane Club, Sherburn-in-Elmet, Yorks. Secretary Lieut.-Col. Walker, The Aerodrome, Sherburn-in-Elmet.

LONDON AEROPLANE CLUB

REPORT for week ending June 17.—Flying time, 51 hrs. 30 mins.; dual instruction, 17 hrs. 40 mins.; solo flying, 33 hrs. 50 mins.

Dual instruction (with Capt. S. L. F. St. Barbe): Miss Wilson, H. R. Presland, A. Courtauld, Miss V. M. Cholmondeley, P. A. Wills, H. Sutton, J. C. V. K. Watson, J. R. Rymill, B. Carey, J. R. A. Stroyan, Maj. R. M. S. Veal, E. G. Amsden, J. A. Crane, G. E. Clair, Miss Johnson, Miss Fletcher.

(With F. R. Matthews): J. Bickley, E. A. Lingard, J. R. A. Stroyan, D. G. Prentice, C. Reilly, C. W. Bonniksen, I. E. Furlong, C. N. Green, G. H. N. Larden, C. G. W. Ebbutt.

Solo Flying: W. Roche Kelly, R. Sanders Clark, J. C. V. K. Watson, H. B. Michelmore, Maj. K. M. Beaumont, Maj. R. M. S. Veal, Lord M. Douglas-Hamilton, H. M. Samuelson, J. J. Hofer, E. R. Andrews, Art. Fowler, Will Hay, E. E. Fresson, P. W. Hoare, J. A. Brewster, F. C. Fisher, G. W. Hall, N. J. Hulbert, L. J. C. Mitchell, E. E. Stammers.

Flying Charges: The following charges will come into force on July 1, 1928:—

Flying Instruction: The charge will be at the rate of £2 per flying hour for the first twelve hours. For any time in excess of twelve hours the charge will be at the rate of £3 per flying hour.

Solo Flying: The charge will be at the rate of £1 per flying hour up to twenty hours in each Club year. For any time in excess of twenty hours in each Club year, the charge will be at the rate of £1 10s. per flying hour.

Any Ordinary Member who shall not, in the opinion of the Instructor, be qualified to fly solo after fifteen hours' dual instruction, shall automatically cease to be an Ordinary Member.

Flying Time.—Members are informed that flying instruction will now be given from 6 a.m. to 11 a.m., and from 5 p.m. till dusk, Mondays excepted.

BRISTOL & WESSEX AEROPLANE CLUB

REPORT for weekending June 16.—Total flying hours, 21.55; dual instruction, 5.45; solo instruction, 2.35; passengers, six flights, 2.00.

Under instruction with Mr. Bartlett: Messrs. Greenhill, Amory, Peters,

Thomas, Lynas, Allinson, Byrnes, Keeling, Lysaght, Girdlestone, Hughes, Godfrey, Jellicoe, Button.

We are looking forward to the arrival of our new slotted "Moth" next week, and with two club machines in use again we trust that there will be a large increase in flying hours. We hope that our chairman will be able to resume his cross-country flights which set so good an example to the other members of the club.

CINQUE PORTS FLYING CLUB

REPORT for week ending Saturday, June 16. Machine: De Havilland "Moth," G-EBWC. Total flying time, 16 hrs. 10 mins.

Dual instruction with Maj Clarke: Miss Allen, 1 hr. 45 mins.; Mr. R. Dallas Brett, 15 mins.; Mr. Douglas, 2 hrs.; Mr. West, 1 hr.; Capt. Took, 2 hrs. 45 mins.; Mr. Pakenham, 1 hr.; Mr. Braddell, 1 hr. 45 mins.; Mr. Story, 15 mins.; Mr. Burren, 30 mins.; Miss Taggart, 30 mins.

Joy rides with Maj. Clarke: Mr. Hill, 10 mins.; Mr. Hardy, 20 mins.; Mrs. Douglas, 10 mins.; Mr. Bumstead, 10 mins.; Mr. Parks, 30 mins.; Mr. Lawson, 10 mins.; Mr. Judge, 10 mins.

Soloists: Mr. K. Edgson Wright, 1 hr.; Mr. R. Dallas Brett, 45 mins.; Mr. Story, 30 mins.; Mr. Douglas, 30 mins.

On Wednesday, Mr. Douglas, of Guards' Depot, Canterbury, did a successful first solo, after 6 hrs. 30 mins. dual, and made a perfect landing. This is the third *ab initio* pupil to be launched in three weeks working, and we expect to launch two more this week.

There is still a vacancy for additional members, and the club is in need of further capital to purchase a second machine. Full particulars may be obtained from the Secretary, 114, High Street, Hythe, Kent.

Although we did 16 hrs. 10 mins. in the period covered by this report, the report does not include Sunday, 10th instant, which was taken in last week's report, and, as usual, there was no flying on Tuesday.

HAMPSHIRE AEROPLANE CLUB

REPORT for week ending June 17.—Total flying time, 45 hrs. 45 mins. Dual instruction, 14 hrs. 15 mins. "A" pilots, 13 hrs. 35 mins. Solo, 12 hrs. 10 mins. Passenger flights, 4 hrs. 10 mins. Tests, 1 hr. 5 mins.

Instruction (with Flt.-Lt. Swoffer): Miss Grace, Mr. Couchman, Sir A. Lindsay-Hogg, Mr. Fawkes, Westlake, Starkey, Smith, Lt. Townsend, Mandeville, Lichfield-Speer, Somerset, Wroughton, Kerry, Luard, Larden, Berent, Watson.

"A" Pilots:—Don de la Cierva, Mr. Ranald, Mrs. Ranald, Mr. Larden, Baynes, Heath, Wells, Parker.

Soloists:—Miss Grace, Mr. Fawkes, Collier, Whittle, H. King, Sir A. Lindsay-Hogg, Westlake, Scott-Hall, Lt. Townsend, Wroughton, Tillard.

Passengers:—Mr. Somerville, Booth, Bridcut, F. W. Bowen, Elliott, Tobutt, Mrs. Vauce, Mr. Bull, Mrs. Bull, Curtis-Nuthall.

We have suffered from the general complaint, *i.e.*, high winds, all this week, but "A" pilots and soloists have managed to get up during the lulls. If this is the beginning of summer, we are hoping that for the sake of flying winter will soon be here.

LANCASHIRE AERO CLUB

REPORT for week ending June 16.—Flying time, 30 hrs. 20 mins. Instruction 14 hrs. 55 mins. Solo flights, 11 hrs. 30 mins. Passenger, 2 hrs. 45 mins. Tests, 1 hr. 10 mins.

Instruction: (with Mr. Baker):—Garner, Taylor, S. Nelson, J. G. Williamson, Benson, Miss Baerlein, Riley, Fallon, Mason, Faulkner, Greenhalgh, Serck, Pattrieoux, Kay, Ashworth, Hall, Gort, Barlow, Sellers, Hartley.

(With Mr. Cantrill):—Miss Baerlein, Ashworth.

Soloists (under instruction):—Gort, Garner, Riley, Harrison, Miss Baerlein, Sellers.

Pilots:—Nelson, D. Caldecott, Meads, Williams, Twemlow, Chapman, Lacayo, Agar, Harber, Hardy, Ruddy, Brooking, Michelson, Hall, Leeming, Fallon, Cohen, Baker.

Passengers:—11 passengers were carried.

No real crashes this week—only a broken car-rod and a completely smashed engine.

Mr. Harrison completed the tests for his "A" Licence and Mr. Riley his height test.

Owing to the exceptionally large number of machines entered for the Blackpool Air Pageant, it is regretted that no late entries can be accepted.

NEWCASTLE-UPON-TYNE AERO CLUB

REPORT for week ending June 10.—Total flying time, 30 hrs. 5 mins., including 7 hrs. 20 mins. at Birmingham.

Instruction.—(With Mr. J. D. Parkinson) 8 hrs. 35 mins.: Mrs. Kish, Miss Trevelyan, Messrs. Nicholls, Maxwell, Linden, Bell, MacKay, Temple, Lawson, Fairless, Percy, Dodds.

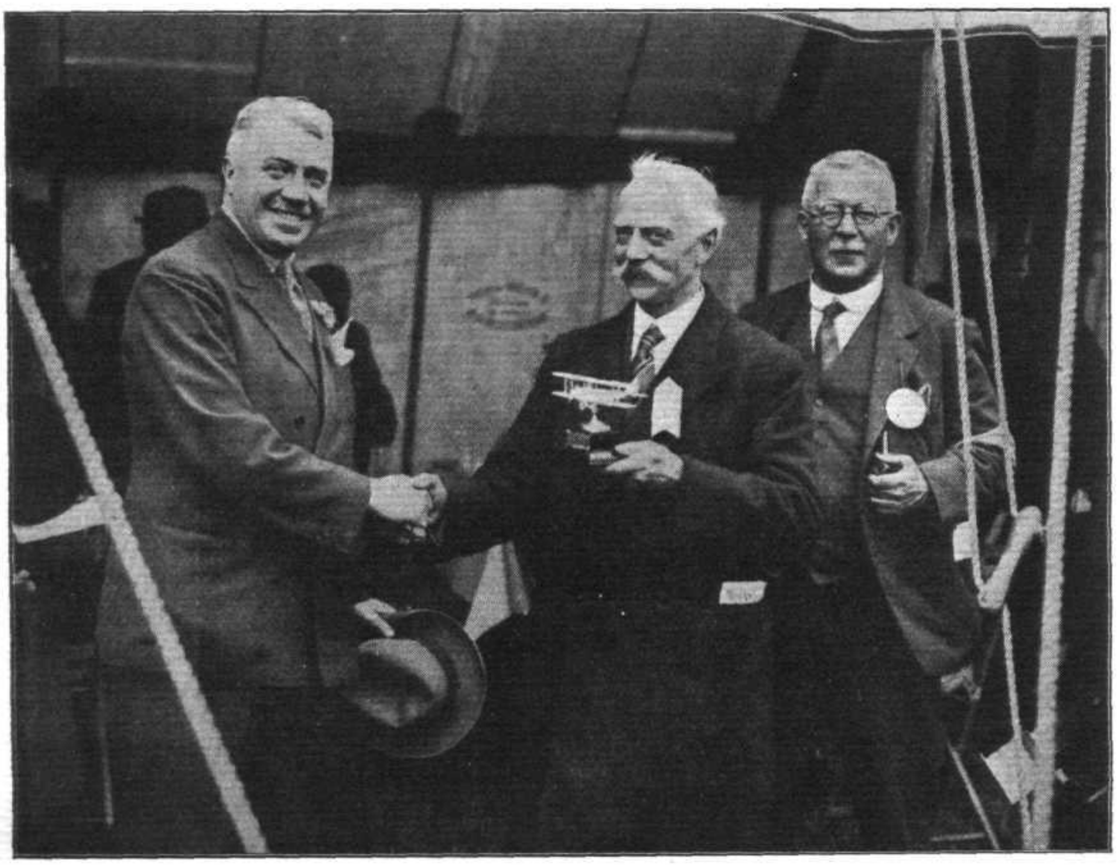
Solo.—(5 mins.): Mr. Maxwell.

"A" Pilots.—(9 hrs.): Mrs. Heslop, Messrs. H. Ellis, C. Thompson, R. N. Thompson, A. H. Bell, C. Wilson, Dr. Dixon, J. T. Percy, F. L. Turnbull, W. B. Ellis.

Passengers (3 hrs. 5 mins.).—Number carried, 23. Tests.—30 mins.

A large crowd gathered on the aerodrome last Friday to await the arrival of Imperial Airways' "Argosy," "City of Glasgow," and Mr. J. D. Parkinson entertained the people with an exhibition of aerobatics, after which, in company with Dr. Dixon, some excellent photographs were obtained.

THE MIDLAND AERO CLUB'S NEW "MOTH": Three members of the Club (l. to r.), Flight-Lieut. T. Rose (Instructor), Mr. W. J. Halland, and Mr. W. F. Sutcliffe, standing in front of the new D.H. "Moth X," "Wulfrun," which was presented to the Club by Messrs. J. D. and N. B. Graham of Wolverhampton. As depicted below, a silver model of this machine was presented to the donors by the Lord Mayor of Birmingham.



Souvenir: The Lord Mayor of Birmingham, Alderman A. H. James (centre), presenting — on the occasion of the Midland Air Pageant last week—to Mr. Graham (left) a model of the D.H. "Moth" which was given to the Midland Aero Club by Messrs. J. D. and N. B. Graham. The Chairman of the Club, Mr. H. A. Pepper, is seen on the right.

["FLIGHT" *Photograph*

NORFOLK & NORWICH AERO CLUB

REPORT for week ending June 17.—Total flying time, 20 hrs. 30 mins,
Instruction (with Mr. Young) :—Messrs. C. Mills, G. Watson Parker, H. P. Clarke, F. Rinder, A. Cooper, F. W. Palmer, H. Cator, H. Neave, G. Wharton.

Soloists :—Messrs. R. T. Harmer, F. Gough, E. Lambert, G. F. Surtees, G. Barker, R. Potter, A. Cooper, W. A. Ramsay, W. P. Cubitt, E. Varden Smith, H. Mack.

Passengers :—Ten.

Mr. A. Cooper has just rehearsed his first solo and it was a very good show. *We compliment him on his industry. He has trained under the difficulty of* not being able to put in much time, just an odd half hour now and again, therefore we feel for him much pleasure.

Messrs. Surtees, Barker and Lambert, have completed all the essentials for their " A " licences and are now whistling " It's a long long time awaiting until the ' A ' 's come through." (Tune " Tipperary.").

The weather is perfectly deplorable for flying here, we only tootle around.

SUFFOLK AND EASTERN COUNTIES AEROPLANE CLUB

REPORT for week ending June 16.—Flying time, 9 hrs. 39 mins. Instruction, 2 hrs. 40 mins. " A " and " B " pilots, 10 mins. Soloists, 2 hrs. 10 mins. Passenger flights, 4 hrs. 5 mins. Tests, 15 mins.

Instruction with Mr. Lowdell :—Dr. Mildred Yate, Miss Rhodes, Messrs. Porritt, B. F. Marriage, G. Smith, Verney, Billinton, Wedd and Goodwin.

Solo under instruction : Messrs. Hanson, G. Smith, Verney and Billinton.

Passengers with Mr. Lowdell, 1. With Mr. Prentice, 1.

Bad weather, combined with the fact that our machine did not return from Birmingham, where Mr. Lowdell was equal first in the Balloon Bursting, has resulted in a reduction of our activities during the week.

The only notable event was that on Saturday evening Mr. Verney successfully completed his height test for his " A " Licence, which he carried out in a very masterly manner.

Two machines are now serviceable, and given fine weather, we hope to obtain quite a bunch of " A " Licences during the next few weeks.

YORKSHIRE AEROPLANE CLUB

REPORT for fortnight ending June 16.—Flying time, 36 hrs. 10 mins. Instruction, 14 hrs. 10 mins. Soloists, 18 hrs. Passengers, 4 hrs.

Instruction (with Captain Beck).—Messrs. Ambler, Arundel, Bell, Blackburn, Brown, Collins, Dujardin, Mrs. Earle, Messrs. Fitton, Gill, Ives, Little, Lupton, Ostler, Park, Reynolds, Rowley, Senior, Shires, Wilson.

Soloists : Messrs. Brown, A. Crowther, Dick, Ostler, Reynolds.

" A " pilots : Messrs. Ambler, Birch, Clayton, H. Crowther, Dawson, Ellison, Humpheries, D. Lax, Lister.

Passengers, 18.

On Sunday, June 3, a little diversion from ordinary routine was enjoyed by way of a Forced Landing Competition, in which some 14 members took part. Captain Beck, the Pilot Instructor, acted as an emergency passenger in each case. The winner was Mr. Jack Ellison, a Club *ab initio* pupil of some months' standing. He made a really stylish approach, a perfect landing, and finished up within a yard or two of the mark.

Since our return from the Midland Pageant we have enjoyed but three days' flying, with two machines, through rain, gales, storms—in fact, the usual summery conditions of this country. On Tuesday, however, we did something in the way of achievement by getting Mr. Ostler to take the air on his own, and in no mean style. Mr. Ostler's visits to the Aerodrome have been few and far between through no fault of his own, and one hopes that now his ambition has been reached, he will earn that £50 before the end of July.

Mr. Downer, who was navigator to Mr. Frank Courtney on his recent Atlantic attempt, is attending the Club each Wednesday, giving a series of lectures on navigation. The second class was well attended by a dozen or more enthusiastic members.

Yesterday we arranged a meeting of the directors and active members to give the latter the opportunity to criticise the Club's policy, and to make suggestions in the furtherance of its interests. We very much appreciated the fact that Lady Heath's enthusiasm brought her all the way from London to attend this meeting and propound some very helpful ideas.

The De Havilland Flying School, Stag Lane Aerodrome

REPORT for week ending June 17.—Total flying time, 112 hrs. 35 mins. Instruction : dual, 32 hrs. 25 mins.; solo, 41 hrs. 50 mins. Other flying, 38 hrs. 20 mins.

Instruction was slightly interfered with owing to the Royal Air Force practising for the pageant in the vicinity of Stag Lane.

One pupil obtained his " A " licence, and two others performed excellent first solos.

Several new pupils joined the school, including Lord Haddington and Sir Pyers Mostyn.

The " Slotted Moth " was demonstrated before representatives of the United States Navy and the Japanese Army, to their great satisfaction.

Twelve new " Moths " were tested for immediate delivery.

Henderson Flying School, Brooklands Aerodrome.

REPORT for week ending June 14.—Total flying time, 25 hrs. 35 mins.

Dual with Lieut.-Col. G. L. P. Henderson : Miss MacDonald, Dr. Forsyth, Mr. Brooks.

Dual with Capt. H. D. Davis : Messrs. Bellamy, Payne, Oldmeadow, Oliver, Saunders, Norbury, Murray-Philipson, Jillard.

Dual with Capt. W. F. Davenport : Messrs. Matos, Knox.

Solo : Messrs. Carlos, Crabtree, Oliver, Murray-Philipson, Allen.

Several pupils are almost ready for solo and five new ones have arrived.

200 passengers were carried during the week.

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Air Mails to South America

THE Postmaster-General announces that an air mail service in Peru, between San Ramon and Iquitos is now available for *unregistered* letters and postcards. Places served : Puerto Bermudez, Contamana, Masisea and Iquitos. The packets will be forwarded by ordinary route to Lima, and thence by train and motor to San Ramon for onward transmission by air. This service should generally give an acceleration of nearly three weeks over the ordinary route via Brazil and the River Amazon. Packets intended for transmission by the service in question must be prepaid with a special fee of 2*s*. for the first *half* ounce, and 1*s*. for each subsequent *half* ounce, or fraction thereof, in addition to ordinary postage. *Such packets cannot be registered.* Limit of weight : 2 kg. (approximately 4½ lb.) . Limits of size : 12 in. in length and 6 in. each in breadth and depth. The packets should be clearly marked " Servicio Aereo " in the top left-hand corner and the usual Air Mail label should be affixed in the top left-hand corner.

The John Bernard Seely Prize

IN addition to taking a first-class in the Mechanical Sciences Tripos, Mr. H. L. Haslegrove, of Trinity Hall, Cambridge, won all three prizes connected with it. He was awarded the Rex Moir Prize for the greatest distinction in the Tripos, the John Bernard Seely Prize for the greatest distinction in Aeronautics, and the Ricardo Prize for the greatest distinction in Thermodynamics.

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The Handley-Page Football Team : Big Air Liners and slotted wings are not the only good things produced by Handley Page, Ltd., of Cricklewood, for their Sports Club has a fine football team, shown here, with many successes to its credit. " H.P." himself (seated in the centre) and the Management are, it may be added, interested in the Sports and welfare side as well as the manufacturing side.

"LABORATORY" LIGHT ALLOYS AND THEIR PRODUCTION COMMERCIALLY

ALUMINIUM alloys have always played an important part in aircraft construction, and their use to-day, with the growing popularity of all-metal aircraft, is increasing more than ever. Owing to its extreme lightness, it is only natural that aluminium has from the first engaged the attention of aircraft and engine constructors. Its application, however, in spite of its promise of immense advantages over other materials, has presented problems of no small magnitude.

Pure aluminium is, of course, seldom used in its original state, and it is in the form of an alloy that it is employed for the various components of aircraft and aero engines. For years past, metallurgists have been experimenting in the production of high-tensile aluminium alloys, with the result that some very promising alloys possessing remarkable qualities as regards strength-for-lightness have been produced from the laboratory.

These alloys were by no means easy to produce, even in the laboratory, considerable care being required in the whole process of their manufacture from beginning to end. It will be seen, therefore, that when it came to producing them on a large scale, commercially, and retaining at the same time a standard uniform quality for any particular alloy, the question became a problem presenting considerable difficulty. In fact, it is generally considered to be impossible to produce, commercially and at low cost, certain high-tensile aluminium alloys having the same standard of quality and composition as that which has been obtained by the metallurgist in the laboratory.

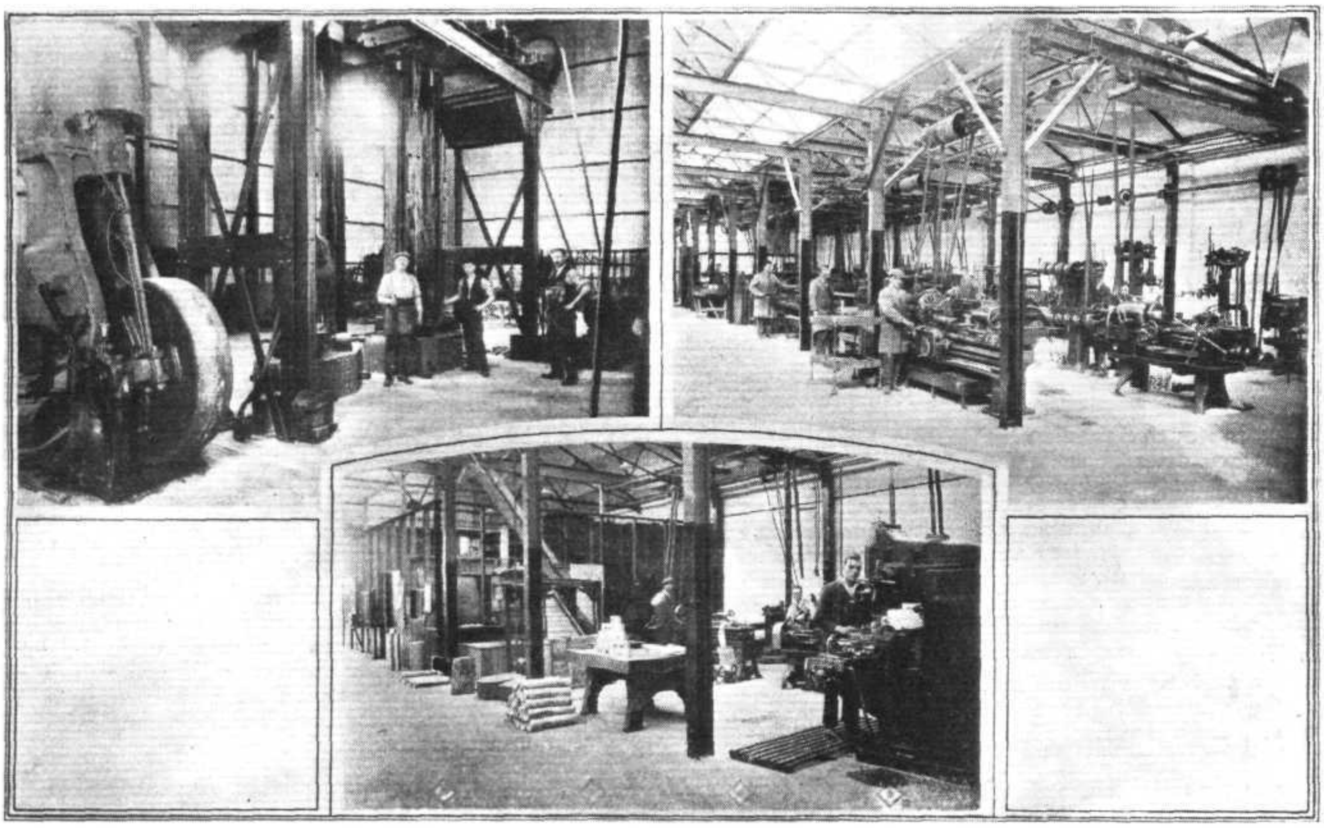
It should be remembered that it is not only a question of obtaining the correct proportions of the constituents that go to make up any particular alloy, but such items as the quality (purity and uniformity) of the raw materials; the melting; the cooling; and the hardening or heat treatment, each presenting a problem calling for extreme care and control during the process of production.

The requirements of the aircraft or engine constructor are such that these aluminium alloys, possessing great strength combined with lightness, are most desirable, so that any attempt at producing them commercially and to laboratory standards—even though the cost of production must necessarily be comparatively high—is a step in the right direction.

Such is the object—and, we think, the achievement—of High Duty Alloys, Ltd., a new company recently formed by Mr. W. C. Devereux, who was formerly works manager of Peter Hooker, Ltd., and who has established works on the Slough Trading Co.'s estate at Slough.

During a recent visit to these works we were very favourably impressed by the methods and system employed by High Duty Alloys, Ltd., in producing high-tensile aluminium alloys—at present the firm is mainly concerned in the manufacture of "Hiduminium," the now much-used "Y" alloy, and the "DV" alloy made to D.T.D. specification 18A, with both of which they have already achieved a reputation amongst several prominent British and foreign aircraft firms.

We do not propose this week to describe in detail what we saw at Slough—we hope we shall have an opportunity of going more fully into this matter on a future occasion—but only wish to introduce our readers to this new and important firm with our present brief remarks and the accompanying illustrations of the works themselves.



"FLIGHT" *Photographs*

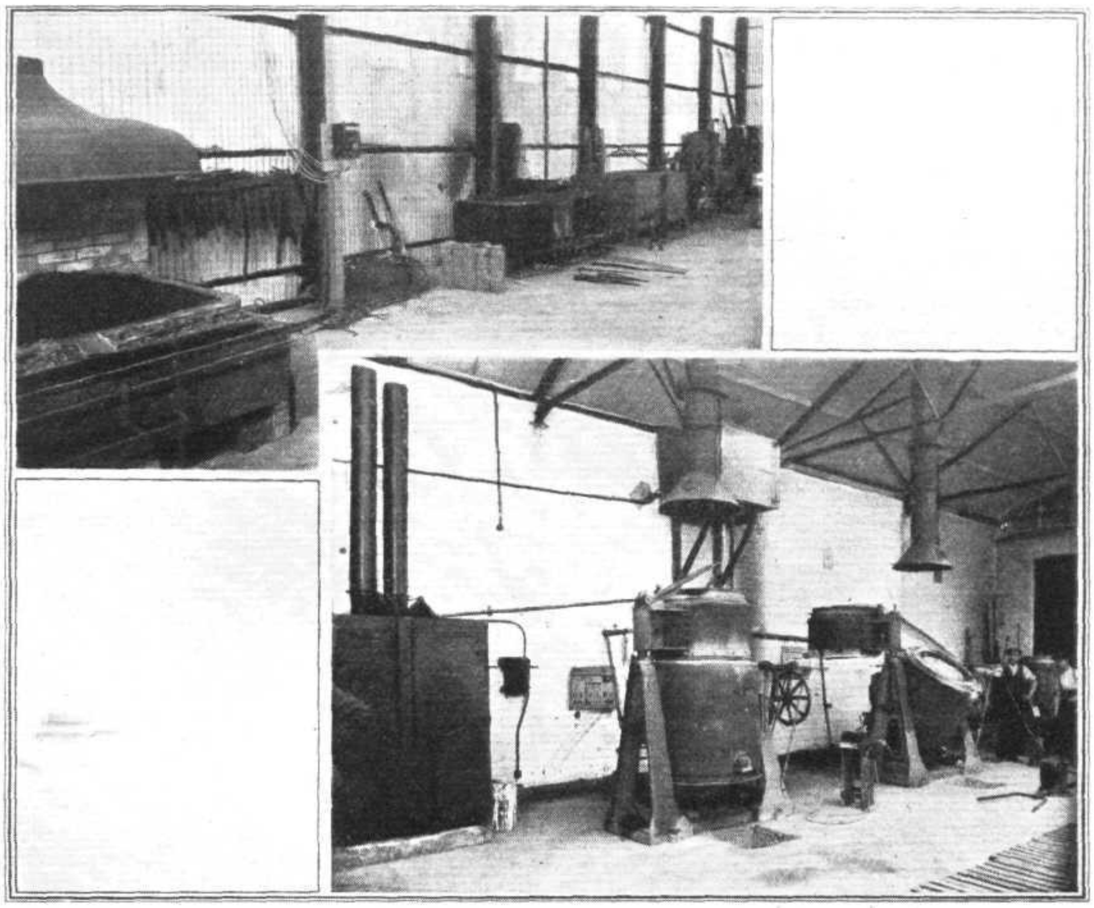
A MODEL FOUNDRY: The workshops. On the left are the hammers for drop forging, etc., and on the right the machine shop, where finished articles, such as pistons, etc., are turned out. Below, another corner of the machine shop, with the stores in the background.

It may be said, however, that the alloys are produced under ideal conditions, and extraordinary care and control is maintained from beginning to end. The works take the form of a large-scale laboratory rather than a foundry—in fact, laboratory methods are employed throughout.

The raw metals—aluminium, nickel, copper, etc.—are first analysed in order to ensure a standard degree of purity, and then the various hardeners are melted from the raw metals, each melt of which is again analysed, given an identification number, and kept in special bins in the stores.

When a particular alloy is required, the correct quantities of the various constituents are drawn from the stores according to the specification, and put into the furnaces. The latter are provided with recording pyrometers, a record of each melt being made on an instrument in the metallurgical office, so that any change in the correct temperature necessary for that particular melt is at once observed. Also, a record of each melt is obtained and kept for future reference.

The ingots having been cast and marked with their melt number, samples are taken and analysed for correct composition, examined microscopically for correct structure, and put into the testing machines for strength. If these prove satisfactory, the ingots are prepared for heat treatment, forging, etc., with the same care and control. Every operation, from



A Model Foundry: Two sections of the High Duty Alloys, Ltd., foundry at Slough. On the right are some of the melting furnaces, where high-tensile aluminium alloys —such as "Y" and "DU"—are produced under ideal conditions, as described elsewhere in this issue. On the left is a corner of the heat-treatment shop. The extreme cleanliness of these works is a noteworthy feature.

["FLIGHT" *Photographs*

start to finish, is in one way or another recorded or identified by a number, so that the production of an alloy—either as an ingot or a finished article, such as a piston—is not only controlled throughout by the firm's metallurgist, but it has its own "history" on permanent record. As a matter of interest, we reproduce in the accompanying table a daily record of a melt, taken the day before our visit to Slough.

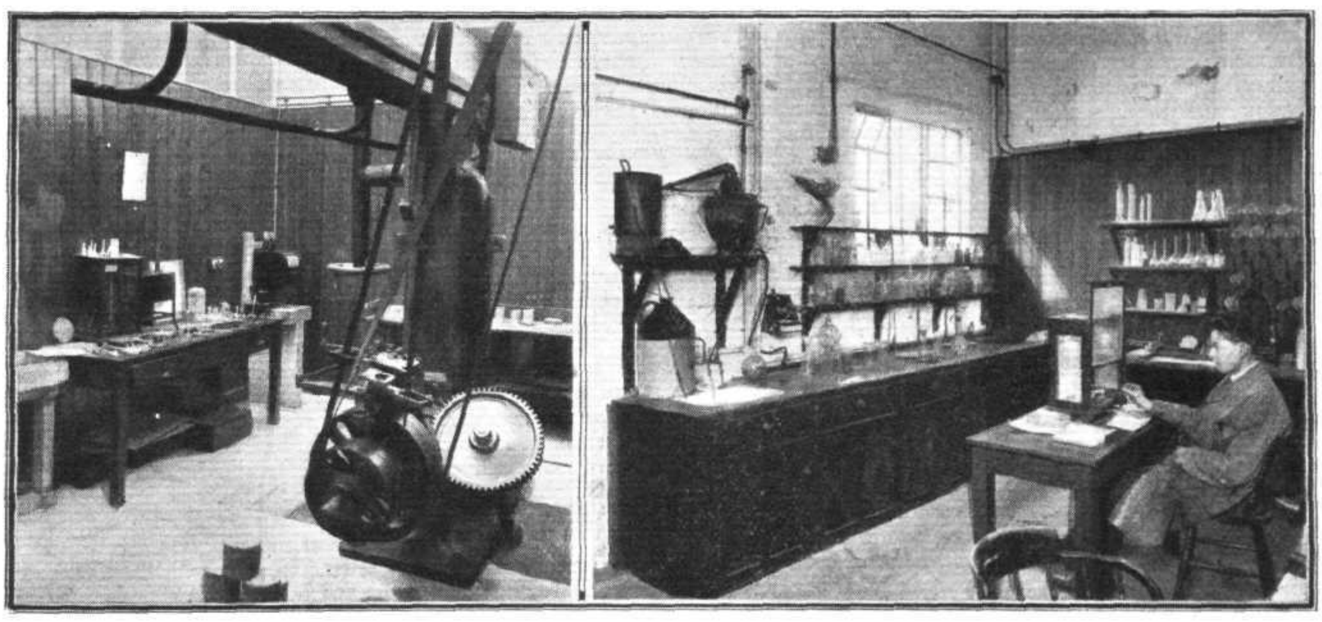
Thus, it will be seen that with such a system in use, High Duty Alloys, Ltd., have little difficulty in producing alloys of exceptional uniformity and quality. In fact, rejections are almost unheard of, and the records of their alloys show that the guaranteed figures for any particular "brand" are easily maintained. For "Y" alloy, in forged state, they guarantee from 22 to 27 tons/sq. in. ultimate strength (17 tons is required officially), and for "DU" (18A), 25 to 30 tons/sq. in. with an elongation of 15 to 25 per cent.

HIGH DUTY ALLOYS, LTD., SLOUGH, LABORATORY

Daily Record of Foundry Melting

Alloy.—Test Pieces Taken from "Y" Metal Forged Piston Blanks.

Melt No.	Yield Point Tons-sq. in.	Max. Stress Tons-sq. in.	Elong. % 2 in.	Redn. Area %	Brinell No.
	1st Heat Treatment				
3077/8T	15·80	21·40	8·50	13·32	98
3078//2T	15·68	21·76	10·00	13·32	104
3079/7T	15·64	21·00	7·50	10·00	101
3080/5T	15·28	22·04	10·00	13·32	101
3081/5T	15·44	21·68	8·50	11·68	101
3082/8T	15·00	20·24	10·00	13·32	101
	2nd Heat Treatment				
3077/8T	20·12	23·80	2·00	4·88	114
3078/2T	20·80	23·84	3·00	6·60	114
3079/7T	21·20	24·40	2·00	4·88	121
3080/5T	19·80	23·68	4·50	8·32	117
3081/5T	20·64	23·92	2·00	4·88	114
3082/8T	19·40	22·52	2·00	4·88	114



["FLIGHT" *Photographs*

A MODEL FOUNDRY : The Laboratory sections of the High Duty Alloys, Ltd., works at Slough. On the left the testing room ; in the far corner will be seen the furnace pyrometer recorder which indicates the actual temperatures obtaining in the furnaces during every melt, thus providing complete control at all times, as well as a permanent record. On the left is the chemical laboratory, where alloy specimens are analysed.

ARCTIC FLIGHTS

Capt. Sir G. H. Wilkins' Two Papers in One Evening

IN attempting to record in any detail the lecture by Capt. Sir G. H. Wilkins, M.C., to the Royal Aeronautical Society, with which is incorporated the Institution of Aeronautical Engineers on June 14, 1928, one is faced with some little difficulty. The famous explorer had written one paper, a printed copy of which was sent around. He then proceeded to give an entirely different lecture, without once referring to notes or to the printed paper. Under the circumstances, the best one can hope for is, perhaps, a few scattered recollections of the spoken lecture, interspersed here and there with passages from the printed paper. The discussion which followed was not a discussion but a series of questions, and thus the task of the unfortunate recorder is further complicated. As was to be expected, the attendance was very large, the fair sex being particularly well represented.

Col. the Master of Sempill was in the chair, and before asking the lecturer to give his paper, he recalled that Capt. Wilkins had, apart from his work of exploration, been flying since 1910, and that in 1919 he was one of several who attempted the London to Australia flight which the brothers Smith accomplished so successfully.

Sir Hubert Wilkins then proceeded to relate some of his experiences in arctic flying, and from these it was evident that although he made light of them, there had been no lack of exciting moments. Particularly vivid was his description, given in an ordinary conversational voice and devoid of any attempt at "effect," of an experience of flying in clouds and fog in Alaska. He, with Eielson as pilot, was trying to get across a mountain range which was reported to be only a few thousand feet high. Looking out of one of the side windows, the lecturer saw mountains close to the wing tip, and shouted to the pilot to turn so as to avoid hitting them. Eielson's answer was: "I can't. There are mountains on my side too." The machine was already at its ceiling, and consequently could be persuaded to climb no higher. There was nothing for it but to go on straight ahead. On happening to look downwards when the danger was past, the lecturer noted for the first time that the wheel which was visible from his window was spinning fast, just as a wheel does immediately after a machine has taken off. Neither he nor Eielson felt any bump, but they concluded that in getting through the gap between the mountains, their wheels must have touched the snow enough to be set spinning!

The great object of all the lecturer's work in Polar regions, and this was obviously the red thread running through all his accounts, the *raison d'etre* of all his endeavours, was the establishment of a circle of observation stations approximately on 80 degrees latitude in the Arctic and Antarctic regions, from which regular reports could be collected and made available. Once that was done, the lecturer thought that so much might be learned by the meteorologists that it would in time—not at once but sometime in the future—become possible to forcast seasonal changes in the weather, and thus to give warning of the coming of conditions which at present led to famine in such contries as Australia, China, India, and South America. That was evidently the ultimate object of the lecturer's great work, and his flights in the Arctic were but means to an end. We point this out because it is of some importance that one should realise that the knighthood was bestowed upon Sir Hubert Wilkins not for a spectacular "stunt" flight across the Polar wastes, but for his long and extremely useful work in examining the possibilities of establishing bases for arctic observatories to be established if found feasible, in the interests of mankind. He has but used aircraft to facilitate that work, and not to gain notoriety for himself. In these days of personal advertising, it is good to find a man who endeavours and achieves for the benefit of the human race, and not for any personal gains.

With this digression we may return to the paper and the lecture. Of his long work in the interests of exploration the lecturer spoke but little, but it was not difficult for the intelligent listener to realise how that work (we are referring now to the "foot-slogging" and not particularly to the flying side), had fitted him for making the best possible use of the facilities which the rapid travel by air has to offer. Also, apart from his familiarity with the appearance of the Arctic wastes and consequent ability to interpret readily what he observed, the lecturer's training with Stefansson had very evidently enabled him to tackle with a fair prospect of success problems which the "tenderfoot" would not be able to solve. Such as, for example, the problem of how to survive and get back to civilisation in case of a forced landing on the ice and the necessity for abandoning the aeroplane. Where, one not accustomed by long training to the hardships and difficulties of travel on foot would in all probability succumb, a man like the lecturer would know how to "live off the country," and would therefore have a chance of getting back with his information.

Of the actual flight from Alaska to Spitzbergen, Sir Hubert said comparatively little. The flight was undertaken deliberately as part of a greater scheme, which was, put very briefly, to fly out from the Alaskan base in various directions looking for land whereon possibly observation stations might be established. In 1926 and 1927, such out-and-back flights were undertaken. There remained but the North-eastern sector. Had land been found on that, Eielson and Wilkins would have either alighted there to examine it, or at least marked down its location and returned to their Alaskan base, to reach the newly-discovered land again on some future occasion. If no land was sighted, it was the intention, should conditions be favourable, to carry on to Spitzbergen.

As it happened, no land was sighted, and after a brief consultation, Eielson and Wilkins decided to carry on. The latter was fairly certain from his experience of Arctic weather, that at Spitzbergen they would encounter a storm and bad weather generally. However, he asked the pilot what he thought, and after considering the matter for a few moments, Eielson replied: "I am willing to go on if you think you can find the way." According to expectations, they did meet very bad weather on arriving near their destination, and had to make a landing at a small island, known as Dead Man's Island. Here they were storm bound for five days, but at last the weather moderated enough to enable them to get to Spitzbergen.

Concerning his experience in flying in Arctic conditions, the lecturer gave an account of the 1926 and 1927 flights, the machines used the first year being a three-engined Fokker with "Whirlwind" engines and a single-engined Fokker with Liberty engine. No real trouble was experienced. For the 1927 flights, a small Stinson biplane, also with Whirlwind engine was used. The Lockheed Vega monoplane used this year, and in which the actual flight from Alaska to Spitzbergen was made, was quite a small affair, and again the Whirlwind was the power plant. Sir Hubert gave the following brief particulars of it: Span, 41 ft.; maximum chord, 8 ft. 6 in.; area, 275 sq. ft. Weight, empty, 1,500 lb. The lecturer stated that the machine carried a load of 3,500 lb., but this seems improbable, and what was probably meant was that, with full load, it weighed 3,500 lb. The machine was of wood construction, and apparently gave no trouble at all. The engine had a tendency to get too cold, and in order to keep it warm, long portions of the flight had to be made by alternately climbing and sideslipping. This meant running the engine close to full power for quite a large percentage of the flight, but, apparently, with no ill effect, except that the amount of fuel consumed was a good deal greater than would otherwise have been the case.

On the Alaskan side of the Arctic sea, the lecturer said, the snow rarely lay more than about 1 ft. deep on top of the ice, and it was quite possible to use a wheel undercarriage. On the Spitzbergen side, however, the snow was deeper, and skis became necessary. The "Vega" was so fitted.

The Discussion

As we have already mentioned, the discussion following Sir Hubert Wilkins' paper turned out to be mainly a series of questions asked. We do not propose to give the questions in detail, as the nature of them will in the main be clear from Sir Hubert's replies. Mr. Griffith Brewer refrained from asking questions, and instead, he congratulated the lecturer on the way he had spoken absolutely fluently for more than an hour without once referring to any notes. He pointed out that this was the first non-stop flight in history which had started in the Pacific and finished in Europe. He also congratulated Eielson on paying his first visit to Europe via Spitzbergen.

Sir Sefton Brancker, Director of Civil Aviation, said that during the war he had the privilege to command an air service unit, and he then formed the opinion that the Australians were going to prove the best pilots in the world.

More recently he had visited America, and had now come to the conclusion that the Americans ran the Australians a very close second. He expressed regret that the flight had not been made on a British machine and financed by British capital, but there were compensations. The lecturer had said that he had flown since 1910. He gathered, however, that Sir Hubert had not a pilot's licence. Perhaps that was just as well, for with the loading referred to, he was afraid the machine would not have been given a certificate of airworthiness !

Sir Hubert Wilkins said that in the Arctic regions his experience was that there were calm zones when one got away from the land. The winds, he thought, did not blow around the Pole, but from it. They had never experienced trouble due to ice collecting on the machine. If the temperature was low enough, it was a sign of dry air. Trouble might occur round about freezing point. He hoped to establish a circle of meteorological stations in the Antarctic, and it was hoped that they would be maintained as follows : 4 by Australia, 4 by South Africa, and 4 by South America.

Concerning keeping warm in the Eskimo skin suits, it was necessary to wear them alone, with the fur nearest the skin. Then they were very warm and comfortable and weighed, but from 7 to 9 lbs. Their food consisted of pemmican, chocolates and biscuits prepared for Amundsen in 1920. They found that they only ate on an average 15 ozs. each per day. The petrol used was ordinary commercial petrol. The compasses were a Pioneer ordinary, a Star compass, and a ship's lifeboat compass. They did not depend much on compasses, but could have done so fairly easily had it been necessary.

In reply to Major F. A. de V. Robertson, Sir Hubert stated that his Antarctic plans were very little changed. These were given very fully in FLIGHT of September 17, 1925, to which issue we would refer readers wishing for further information concerning the future endeavours of Capt. Sir G. H. Wilkins.

HONOURING SIR G. HUBERT WILKINS

CAPT. SIR G. HUBERT WILKINS and his pilot, Lieut. C. B. Eielson, were, on June 13, the guests of the Royal Aeronautical Society, the Royal Aero Club, the Air League of the British Empire and the Society of British Aircraft Constructors at a luncheon at the Savoy Hotel, when Brig.-Gen. Lord Thomson, chairman of the Royal Aero Club, presided.

The chairman, in proposing the health of the guests, briefly referred to Sir Hubert Wilkins' descent from a bishop of Chester 400 years ago, who he said was, according to history, also interested in aviation. And so it came about that Sir Hubert has in our days rendered a service to aviation and the world by his exploration in helping forward in real progress and in the avoidance of suffering. As to Lieut. Eielson, he had had three and a half years' experience in the Arctic and Sir Hubert Wilkins in his own words described him as "the perfect pilot."

Sir Hubert Wilkins, in responding, said that although he had learnt to fly 18 years ago, his interest was not primarily aeronautical, but rather meteorological. Sir Hubert then proceeded to give a few details of his experiences in the flight, in the main as set forth in the paper which he read before the Aeronautical Society on the 14th inst., a summary of which is given in this issue of FLIGHT. Sir Hubert emphasised that he had no intention whatever of going *over* the North Pole, but *round* the Pole. The former would not have served their purpose at all, and they thus succeeded in their quest of solving the question whether there was or was not land at certain points, as had been alleged. In work of this character he said the great difficulty presented itself when one man was piloting and another navigating, in that of co-operation. Without it success would be impossible. But in Eielson he found fortunately the most wonderful pilot, and so he repeated without both a perfect pilot and a perfect machine, to have carried out the object with which they set out would have been impossible. Their flight had been of negative value in that they had found no land on which a meteorological station could be established, though information of Arctic weather might be of extreme importance to air transportation and the world in connection with the forecasting of weather conditions, as had been pointed out by Stefansson. From Berlin the Aero-Arktis was at work with the problem of setting up a chain of observation stations in these regions and they had been steadily mapping out and arranging practical details for the past five years. They had gone further than any others in the world and they hoped before long to issue their report whereby it would be possible to take advantage of the meteorological conditions to establish regular and commercial transportation.

He hoped in his forthcoming flight in the Antarctic to show that there was a direct relationship between the southern and northern hemispheres, and the conditions at the two Poles.

They could not expect to reap great advantages in the northern hemisphere unless they had similar observations in the southern hemisphere, and he hoped to interest the peoples of South America in the problem in the same way as the nations in the northern hemisphere had become alive to the importance of Polar investigation.

Lieut. Eielson also shortly replied, and said that pilots in America sometimes thought that England had not given their old pioneers enough credit for their splendid work in the past. He expressed his sincere thanks for their reception in England.

A vote of thanks to Lord Thomson for presiding closed the proceedings.

Amongst the guests invited to meet Sir Hubert were :—Capt. P. D. Acland Mr. C. V. Allen, Comdr. James Bird, Mr. R. Blackburn, The Hon. Alan R. Boyle, Mr. Griffith Brewer, Mr. T. W. K. Clarke, Mr. John E. Carberry, Sir Alan J. Cobham, Mr. H. J. Corin, Lieut.-Col. M. O. Darby, Mr. C. R. Fairey, Mr. P. Gardner, Mr. C. G. Grey, Brig.-Gen. Groves, Mr. J. E. Hodgson, Mr. E. J. B. How, Lieut.-Col. J. Barrett-Lennard, Mr. John Lord, Major R. H. Mayo, Dr. G. Merton, Lieut.-Col. J. T. C. Moore-Brabazon, M.P., Mr. H. H. Morris, Mr. F. Handley Page, Mr. J. L. Parker, Mr. G. G. Parnall, Lieut.-Comdr. H. E. Perrin, Mr. H. E. Pooley, Mr. J. Laurence Pritchard, Major F. A. de V. Robertson, Mr. H. O. Short, Mr. Cecil J. Sibbett, Mr. T. O. M. Sopwith, Mr. Stanley Spooner, Sir Henry White-Smith, Mr. B. Stevenson, Mr. G. Holt Thomas, Lieut.-Col. N. G. Thwaites, Major C. C. Turner, Mr. H. T. Vane, Capt. Wilson.

Death of Capt. O. Vickers

WE very much regret to report the sudden death of Capt. Oliver Vickers on June 17. He died from septic pneumonia after 24 hours' illness. Capt. Vickers was born on September 13, 1898, and educated at Rottingdean and Eton. He left Eton at the age of 17 to take up flying at Hendon where he took his ticket in 10 days, after which he was unofficially attached to a squadron at Joyce Green, where he received advanced instruction from the late R. H. Barnwell. He joined the R.F.C. on his 18th birthday and was sent to France with No. 20 Sqdn. on June 6, 1917.

Capt. Vickers greatly distinguished himself in France as a daring and skilful pilot, having with various observers accounted for 11 machines between June 6 and August 17, the last day he and his observer, Lieut. Hone, flew single handed 12 miles over the German lines after a squadron of 11 machines, believed to be Richthoven's, accounting for five of the enemy machines and just managing to reach our lines before coming down with undercarriage shot away and the machine riddled with over 200 bullets. A few days later Capt. Vickers was sent home to rest, after which he was put in charge of an Instructional Flight Group at Shotwick, and was made captain in 1918.

On demobilisation he joined the aviation department of Messrs. Vickers at Knightsbridge, later being made a special director.

Foreign Missions at the R.A.F. Display

IN addition to our Italian visitors to the R.A.F Display—mentioned last week—five other foreign official missions are reported to be coming from Belgium, Denmark, France, Norway, and Sweden.

R.100 Nearly Ready

IT is expected that the R.100 airship being constructed at Howden in Yorkshire by the Airship Guarantee Co., Ltd., will be ready for trial flights at the end of August or the beginning of September. Arrangements are in hand for the visit of Members of Parliament on July 5 to inspect the airship.

AIR SURVEY DEVELOPMENTS

THE Aircraft Operating Company's South American air survey expedition, consisting of some 16 Europeans, under the leadership of Colonel T. T. Behrens, is now en route for Rio de Janeiro, where the company have secured an important contract to carry out a survey of the city and the federal district, by a combination of ground survey methods assisted by aerial photography.

Two aircraft will be used for the survey—a Vickers "Vendace" seaplane with a "Nimbus" engine, and a "Moth" seaplane with a "Cirrus" engine, fitted with Handley-Page slots. In addition to this, Eagle cameras will be used for taking the photographs. This equipment, together with the latest type of surveying and photographic instruments, and Capt. S. H. Holland, who is the chief pilot to the expedition, sailed on June 6.

It will be recalled that The Aircraft Operating Company secured this contract in the face of powerful international competition. The expedition represents the latest thing in scientific equipment, and full advantage has been taken in the organisation of the expedition of the valuable experience secured by the company in their air surveys in Rhodesia, and also in the revision work which they carried out for the Ordnance Survey in this country.

News has also been received that the company's Middle East expedition is now at Baghdad, and work is about to start on the air survey contract that has been secured with the Iraq Government. Major Cochran-Patrick is at present at Cairo, having carried out a remarkable journey from Bulawayo by motor-car and steamer, and he is about to leave for Baghdad by air.

It is the policy of the company to establish these three expeditions permanently. The South African expedition, which was originally taken out to Africa by Maj. Cochran-Patrick, is now under the leadership of Maj. R. A. Logan, and arrangements are being made to establish a permanent base at Bulawayo; and the company propose to erect steel hangars there, providing that satisfactory arrangements can be made with the Government of Southern Rhodesia. The Middle East expedition, on the completion of the Iraq survey, will probably be divided into two expeditions, one of which it is hoped to establish in North East Africa, and the other will be used for air survey work in India and the Middle East. The Company are also hoping to establish a further air survey unit on the West Coast of Africa.

In order to cope with the increased work that these expeditions will involve at home, the company have just purchased a modern daylight factory at Hendon, which they are fitting up as photographic laboratories and drawing offices. The building, when completed, will be taken over by their subsidiary company, Aerofilms, Ltd.

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CORRESPONDENCE

The Editor does not hold himself responsible for opinions expressed by correspondents. The names and addresses of the writers, not necessarily for publication, must in all cases accompany letters intended for insertion in these columns

PIONEER BRITISH DESIGNERS

[2173] While appreciating the work done by Mr. A. V. Roe in aeronautics, I do not think, on evidence, the claim that he was the father of the tractor aeroplane, made in FLIGHT of June 7, can be substantiated—at least, in the models flown in the *Daily Mail* competition in 1907. I remember them well as being very crude, composed principally of paper, wood and string, and when compared with modern practice there is no similarity in design. I also disagree with Lieut.-Col. Lockwood Marsh that vertical speed, excellence of design and construction, available lifting power, strength of material used, or speed entered into the awards.

The prizes went to paper and string models which practically had no speed or upward lift, and therefore received no shocks when landing. If the photographs published in the press at that date are studied (especially in the *Automotor Journal Yellow Cover*), it will be seen that my corrugated all-metal tractor monoplane made the highest and fastest flight. It rose to over 35 ft. in 15 seconds. Owing to its high speed, it smashed on its first flight when it touched the ground, and was put out of action. This model embodied the following features, which are now standard practice in modern machines (especially in Germany where advanced design is appreciated and encouraged): all-metal corrugated body and wings; tractor metal flexible automatically varying pitch propeller; hemispherical entry enclosed streamline body; non-lifting tail and hinged elevating flaps; no external struts or wire bracing. The value of this non-lifting tail was not appreciated until some years after Bleriot flew the Channel with a machine fitted with a lifting tail. This tail and other features in the machine won the first prize for design, presented by the President of the Aeronautical Society in 1902. The corrugated system of metal construction was adopted by Prof. Junkers in 1918 to straff the British trenches with machine-gun fire. The latest popular Junkers passenger corrugated monoplanes are identical with my original design, except that they are fitted with two motors. If the models which won the *Daily Mail* prizes secured their awards on their merits as stated by Lieut.-Col. Lockwood Marsh, it would appear that the judges at that time suffered with restricted vision.

The late Hon. Charles Rolls was the only expert who appreciated my design, because in describing the models in the *Evening News*, he said my system of design would be extensively used in the future construction of aeroplanes and airships, which prophecy German engineers have proved correct. War Office experts told me metal aeroplanes would never fly as they would be too heavy, and if they did they would smash when they touched the ground because they would be too rigid. Their ideas of an aeroplane then was comparable to linen drying on a wire on a windy day after the Cody type of machine.

Pall Mall, June 10, 1928. WILLIAM COCHRANE

[The reference in FLIGHT of June 7 to Mr. Roe as the "father of the tractor aeroplane" was, as we think was obvious from the context, to full-size aeroplanes, and not to models. Mr. Cochrane's reference to the Junkers used for "straffing" the British trenches in 1918 is rather misleading. In point of fact, the Junkers machine used for that purpose had a plain metal armour-plate fuselage, and the corrugated construction had been used by Prof. Junkers previously. Also, very few modern Junkers monoplanes have two engines. They have either one or three.

Without wishing to enter into an argument as to the relative merits of Mr. Roe's and Mr. Cochrane's early models, we would point out that it would seem that the War Office experts, to whom Mr. Cochrane refers somewhat sneeringly, were not so very far wrong after all, for he himself admits that his model "smashed on its first flight when it touched the ground." The whole thing appears to us to boil down to this: that Mr. Cochrane was attempting to use in model size a form of construction which was applicable only to full-size machines, while Mr. Roe used "stick and string" methods, which *enabled him to make his models fly*.—ED.]

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Supermarine "Southamptons" for the Argentine and Japan

ONE of the most important foreign contracts ever secured by Great Britain for sea-going aircraft has just been concluded by the Supermarine Aviation Works, Ltd., of Southampton. This is a contract for six "Southampton" flying-boats (Napier "Lion" engine) for the Argentine Navy. Five of these "Southamptons" will be of the wooden-hull type, similar to those supplied to the Australian Government, while the sixth will be the metal-hull type, similar to those engaged on the R.A.F. Far East Cruise. Another contract has also been secured by this firm for a metal-hull "Southampton" for the Imperial Japanese Navy, and we understand that if the trials of this machine in Japan are satisfactory, further orders will be placed. It is suggested that the successes achieved by the Supermarine Company at the last Schneider Trophy race and in the Far East Cruise have largely influenced the placing of these contracts. If this be so, it demonstrates the importance of Air Ministry enterprises of this character, and the resulting assistance they give to the British Aircraft Industry. Nevertheless, Comdr. James Bird, Chairman and Managing Director of the Supermarine Aviation Works, Ltd., is to be congratulated on having secured these contracts in face of strong foreign competition.

THE ROYAL AIR FORCE

London Gazette, June 12, 1928.

General Duties Branch

The following are granted perm. commns. in ranks stated (June 1):—

Flight-Lieut.—T. B. Bruce, M.C. Flying Officers.—P. G. Chichester, E. C. Dearth, P. J. A. Hume-Wright, F. R. D. Swain, R. T. Taaffe, M. Wiblin, J. H. Woodin.

The following are granted short-service commns. as Pilot Officers on probation with effect from, and with seniority of, May 25:—J. C. Allan, C. W. Black, R. A. Bloice, G. R. Chameroy, P. J. Connolly, H. Cook, J. Coverdale, J. Cox, P. J. J. Cullinan, R. F. J. D. Webb, T. W. G. Eady, J. K. Flower, H. C. Friday, B. H. Gahan, J. C. Harcombe, G. A. E. Harkness, C. V. Howes, R. Louis, M. L. McCulloch, A. C. Mitchell, E. C. Passmore, R. C. I. Pearse, P. K. Robertson, J. R. Robins, E. Rotheram, W. Smith, H. V. Thomas, P. C. Wilkin, J. Wilson.

R. E. Watts is granted a short-service commission as Pilot Officer on probation with effect from May 27, and with seniority of May 25; Pilot Officer on probation A. R. S. Davies is confirmed in rank (April 30); Flight-Lieut. F. H. Williams is placed on retired list (June 7). The following Flying Officers are transferred to Reserve, Class A, with effect from dates indicated:—A. G. Moon (June 1); C. E. C. Penny (June 6); E. D. Cummings, D.F.C. June 7); O. V. Lee (June 12). Flying Officer W. G. Pudney resigns his short service commn. (May 31).

The short service commns. of the following Pilot Officers on probation are terminated on cessation of duty:—W. H. B. De Courcy-Wheeler (June 6); J. E. McCann (June 13).

Accountant Branch

Flight-Lieut. (acting Squadron Leader) P. J. Farmer relinquishes acting rank of Squadron Leader on ceasing to be employed at Fleet Air Arm Accounts Office, China (May 26).

Medical Branch

Flight-Lieut. J. A. Perdrau, M.D., relinquishes his temp. commn. on completion of service and is permitted to retain his rank (June 1); Temporary Capt. A. H. Mills (Dental Surgeon, General List), is granted temp. commn. as Flight-Lieut. on attachment to the R.A.F. (June 1); Temporary Lieut. H. D. Humphreys (Dental Surgeon, General List) is granted a temp. commn. as a Flying Officer on attachment to R.A.F. (June 1).

RESERVE OF AIR FORCE OFFICERS

General Duties Branch

The following Pilot Officers on probation are confirmed in rank:—CLASS A.A. (ii).—H. Spooner (May 9); G. A. R. Malcolm (May 25); E. F. Rhodes (June 8); D. F. C. Brecknell (June 8).

Special Reserve

F. Davison (Aug. 18, 1927); J. Sillery (Feb. 22).

The following Flying Officers are transferred from Class A to Class C:—L. S. Punnett (May 16); A. H. C. Derby (May 9); W. Dougall (May 11) The following are transferred from Class B to Class C:—Squadron Leader E. D. Galloway (April 15); Flight-Lieut. F. S. Moore (June 12); Flight-Lieut. E. P. Terry (June 12); Flying Officer E. J. Newman (June 12).

Flight-Lieut. S. C. Harker is transferred from Class C to Class A (May 23) Flying Officer A. C. Walker relinquishes his commn. on completion of service, and is permitted to retain his rank (June 8). The commns. of the following Pilot Officers on probation are terminated on cessation of duty:—T. G. Jones (May 11); R. Pankhurst (May 17).

Flying Officer J. A. Mollison is removed from the Service (June 5); Pilot Officer A. B. Mitchell relinquishes his commn. in the Special Reserve on account of ill-health and is permitted to retain his rank (June 13).

AUXILIARY AIR FORCE

General Duties Branch

No. 601 (COUNTY OF LONDON) (BOMBING) SQUADRON.—Pilot Officer R. I. Forbes-Leith resigns his commission (June 13).

No. 602 (CITY OF GLASGOW) (BOMBING) SQUADRON.—The following Pilot Officer (since deceased) to be Flying Officer:—J. P. Drew (May 19).

ROYAL AIR FORCE INTELLIGENCE

Appointments.—The following appointments in the Royal Air Force are notified:—

General Duties Branch

Wing Commander J. V. Steel, O.B.E., to R.A.F. Depot, Uxbridge, 1.5.28.

Squadron Leaders: E. J. P. Burling, D.S.C., D.F.C., to R.A.F. Depot, Uxbridge, 11.6.28. R. G. Gardner, D.S.C., to H.M.S. *Vindictive* 11.6.28.

Flight Lieutenants: H. R. B. Howell, to R.A.F. Depot, Uxbridge, 28.4.28. V. M. Kenny-Leveck, to R.A.F. Depot, Uxbridge, 4.5.28. R. St. H. Clarke, A.F.C., to Aeroplane and Armament Experimental Estab., Martlesham Heath, 29.5.28. J. W. Baker, M.C., D.F.C., to R.A.F. Depot, Uxbridge, 5.4.28. J. S. T. Fall, D.S.C., A.F.C., to Experimental Section, Royal Aircraft Estab., S. Farnborough, 25.6.28. J. S. L. Adams, to Home Aircraft Depot, Henlow, 21.5.28. L. G. Maxton, A.F.C., to R.A.F. Base, Calshot, 17.5.28. G. H. Smith, to No. 25 Sqdn., Hawkinge, 18.5.28.

Flying Officers: A. A. Jones, to R.A.F. Depot, Uxbridge, 20.4.28. F. E. North, to Sch. of Army Co-operation, Old Sarum, 21.5.28. H. W. Taylor, to Armament and Gunnery Sch., Eastchurch, 11.5.28. J. V. Yonge, to No. 3 Sqdn., Upavon, 11.6.28. Hon. Flight-Lieut. G. N. Carroll, to R.A.F. Base, Calshot, 1.10.27. C. V. Lock, to 99 Sqdn., Upper Heyford, 18.5.28. J. J. Nolan, to R.A.F. Depot, Uxbridge, 18.5.28. N. J. Wiltshire, to R.A.F. Depot, Uxbridge, 18.5.28. L. H. Ross, to No. 43 Sqdn., Tangmere, 18.5.28. W. F. Rimmer, to No. 24 Sqdn., Northolt, 18.5.28. S. H. V. Harris, to R.A.F. Depot, Uxbridge, 25.5.28. P. B. Chubb, to Armament and Gunnery Sch., Eastchurch, 18.5.28. H. Waring, to R.A.F. Base, Calshot, 1.10.27. R. S. Barbour, to R.A.F. Depot, Uxbridge, 17.5.28. R. Melbourne, to Home Aircraft Depot, Henlow, 17.5.28. F. J. Parker, to Aircraft Depot, India, 10.5.28. J. C. Cunningham, to No. 20 Sqdn., India, 10.5.28.

Pilot Officers: H. G. Wheeler, to No. 39 Sqdn., Bircham Newton, 11.6.28. G. I. L. Saye, to R.A.F. Base, Calshot, 1.1.28. The undermentioned Pilot Officers are posted to No. 4 Flying Training Sch., Egypt, with effect from 8.6.28:—J. C. Allan, C. W. Black, R. A. Bloice, G. R. Chameroy, P. J. Connolly, H. Cook, J. Coverdale, J. Cox, P. J. J. Cullinan, R. F. J. Doran Webb, T. W. G. Eady, J. K. Flower, H. C. Friday, B. H. Gahan, J. C. Harcombe, G. A. E. Harkness, C. V. Howes, R. Louis, M. L. McCulloch, A. C. Mitchell, E. C. Passmore, R. C. I. Pearse, P. K. Robertson, J. R. Robins, E. Rotheram, W. Smith, H. V. Thomas, R. E. Watts and J. Wilson.

Accountant Branch

Flight Lieutenant A. E. Vautier, to H.Q., Coastal Area, 27.4.28.

Flying Officers: W. R. Donkin, to R.A.F. Depot, Uxbridge, 3.3.28. J. Charles, to No. 47 Sqdn., Middle East, 26.4.28. A. E. West, to No. 2 Armoured Car Company, Middle East, 8.5.28.

Flying Officer J. J. Caiger, to No. 203 Sqdn., Middle East. 31.5.28.

Medical Branch

Flight Lieutenant G. E. Church, M.B., to R.A.F. General Hospital, Iraq, 13.5.28.

Flight Lieutenant (Dental) A. H. Mills, to H.Q., Cranwell, on appointment to a temp. commn., 1.6.28.

Flying Officers: J. Hill, M.B., to R.A.F. Combined Hospital, Iraq, 9.5.28. L. Freeman, to Station H.Q., Hinaidi, 10.5.28.

FELIXSTOWE R.A.F. SPORTS

ON June 13 last, accompanied by real June weather, the Felixstowe R.A.F. Marine Aircraft Experimental Establishment Annual Sports were held on the Town Ground, Felixstowe. An excellent programme was provided, and in addition to the individual championships the Inter-flight competition contributed largely to the excitement of the proceedings. In this, No. 3 Flight, which is constituted of the staff, gained a narrow victory over No. 1 Flight (flying) and No. 4 Flight (workshops), who tied for second place. The result was doubtful until almost the end, when in the mile team race No. 4 won with the lowest aggregate of 25, No. 3 being second with 26, and No. 1 third with 27.

The feature of the day was the success achieved by Flying Officer Darbishire, who—in spite of but a recent discharge from hospital—won the long jump, the hurdles championship, and the high jump championship—all of which gained him the Championship cup. A./C. Blick, much to every one's surprise, was defeated in the mile championship, it being the opinion that he simply gave this event away to L.-A./C. Hand by bad judgment. However, he won in the half-mile.

The officials for the afternoon were as follows:—

Chief Judge, Wing-Comdr. G. R. Bromet, D.S.O., O.B.E. Judges: Sqdn.-Ldr. C. L. Scott, D.S.C., Flight-Lieut. Clift, Flight-Lieut. Cahill, Flight-Lieut. Wincer, and Sergt.-Maj. Treadwell. Referees: Flying Officer Goadsby and Flight-Lieut. Wardle. Starters: Sqdn.-Ldr. Woodhouse, D.S.O., and Flight-Lieut. C. Wilcock, A.F.C. Timekeepers: Flight-Lieut. C. N. Comper, Flight-Lieut. W. E. Dipple, and Mr. A. G. Beverley (S.C.A.A.). Stewards: Flight-Lieut. Hatcher, Sergt. Dawes, Sergt. Holbourn, Sergt. Mousley, and Sergt. Tapley.

At the conclusion of the sports the prizes were presented by Mrs. G. R. Bromet.

Results

One Mile Handicap.—1, White; 2, Heatley; 3, Ogilvie.

100 Yards Handicap.—1, Bennetts; 2, Milton; 3, Collins.

440 Yards Championship.—1, L.-A./C. Toach (No. 3 Flight); 2, A./C. Milton (No. 1 Flight); 3, L.-A./C. Hand (No. 4 Flight).

One Mile (Open).—1, Blick (Felixstowe R.A.F.); 2, R. Hill (Felixstowe); 3, A./C. Knock (Felixstowe R.A.F.).

Long Jump Championship.—1, Flying Officer Darbishire (No. 1); 2, A./C. Carnell (No. 1); 3, Sergt. Dawes (No. 4). 19 ft. 11 ins.

100 Yards (Open).—1, Cpl. Hudson (R.A.F., Martlesham); 2, A./C. Bennetts (R.A.F., Felixstowe); 3, A./C. Morton (R.A.F., Martlesham). Time, 10⅗ secs. Won by 3 yards.

100 Yards Championship.—1, Sergt. Dawes; 2, A./C. Toach; 3, Flying Officer Mortimer (No. 1). Time, 11 secs. A close finish, inches separating the first three.

880 Yards Championship.—1, L.-A./C. Blick (No. 3); 2, L.-A./C. Hand; 3, A./C. White (No. 3). Time, 2 mins. 16⅖ secs. Won by 20 yards, 30 yards separating second and third.

One Mile Relay Medley for the Wyn Evans Cup.—1, No. 3 Flight; 2, No. 4 Flight; 3, No. 1 Flight. The Works took the lead on the half-mile to win easily.

Tug-of-War.—No. 4 Flight beat No. 1 Flight by two pulls to nil.

Three Miles Flat.—1, A./C. Blick; 2, L.-A./C. Hand; 3, A./C. White. This was decided on Monday evening.

120 Yards Hurdles Championship.—1, Flying Officer Darbishire; 2, Sergt. Hunter (No. 4); 3, A./C. White. Time, 17⅘ secs. Won easily. Carnell knocked down three hurdles.

One Mile Relay Championship (4 × 440).—1, No. 1 Flight; 2, No. 3 Flight. Time, 4 mins. 8⅖ secs.

Three-legged Race.—1, Asbee and Carnell; 2, Sergt. Dawes and Sergt. Pollitt.

One Mile Championship.—1, L.-A./C. Hand; 2, A./C. Blick; 3, A./C. White. Time, 5 mins. 44 secs. Hand had a lead of over 60 yards on the second lap; Blick caught up, and then threw the race away.

220 Yards Championship.—1, A./C. Bennetts (No. 3); 2, Sergt. Dawes; 3, A./C. Milton (No. 1). Time, 25⅕ secs.

Two Miles Cycle Race.—1, Sergt. Cook; 2, A./C. Horser. A runaway victory.

One Mile Open Relay Medley.—1, Martlesham R.A.F.; 2, Felixstowe R.A.F. Time, 4 mins. 11⅕ secs. The winners were never challenged.

High Jump Championship.—1, Flying Officer Darbishire; 2, Flying Officer Mortimer (No. 1); 3, L.-A./C. Parsons (No. 1). Height, 5 ft. 5½ ins.

N.C.O.'s Race.—1, Sergt. Hunter; 2, Flight-Sergt. Goodwin; 3, Cpl. Dean.

One Mile Team Race.—1, No. 4 Flight, 25 points; 2, No. 3 Flight, 26 points; 3, No. 1 Flight, 27 points. Individual winner, A./C. Blick.

Ladies' Thread-the-Needle.—1, Miss Warren; 2, Mrs. Wicks; 3, Miss Hill.

Children's Race.—1, Master Hunter; 2, Master Durrant; 3, Master Pack.

One Mile Walk.—1, Drake; 2, Flight-Sergt. Cook; 3, Barnes.

Band Race.—1, Sergt. Middleton; 2, A./C. Sampson; 3, L.-A./C. Parsons.

Inter-Flight Challenge Cup.—1, No. 3 Flight, 27 points; 2, Nos. 1 and 4 Flights, 25 points (tie).

Championship Cup (presented by Wing-Comdr. G. R. Bromet, D.S.O., O.B.E.).—1, Flying Officer Darbishire, 9 points; 2, A./C. Blick and L.-A./C Hand, 8 points; 4, A./C. White, 7 points.

Officers' Cup for the Best Performance.—L.-A./C. Toach.

ANOTHER ATLANTIC FLIGHT

(*Concluded from page* 460)

President Coolidge sent the following message :—

"I wish to express to you, the first woman successfully to span the North Atlantic by air, the great admiration of myself and the people of the United States for your splendid flight. Our pride in this accomplishment of our countrywoman is equalled only by our joy over her safe arrival."

The President also telegraphed tributes to Com. Wilmer Stultz, the pilot of the seaplane, and the mechanic, Mr. Gordon.

The Fokker machine used is of the cantilever monoplane type, the wing being entirely of wooden construction, and the fuselage is the cabin design and constructed of welded steel tubing. This type has been successfully flown by Commander Richard Byrd on his North Pole flight and Atlantic crossing, and its most recent success prior to Miss Earhart's flight was the crossing of the Pacific, a distance of about 7,000 miles. A fleet of them operate on the Dutch air lines between London and the Continent. They can be powered with Armstrong Siddeley "Lynx" 200 h.p. engines, or the Wright "Whirlwind" 200 h.p. engines. The "Whirlwinds" were on the "Friendship" and also on the "Southern Cross" which crossed the Pacific, and the magnetos in both machines were Scintilla.

The "Friendship" resumed its flight from Burry Port on June 19 and landed at Southampton followed by the Imperial Airways Supermarine "Sea Eagle," and escorted by R.A.F. machines.

AIR MINISTRY NOTICES

Revised Housing and Landing Fees for Civil Aircraft at Croydon and Lympne Aerodromes

1. THE following fees are now in force at Croydon and Lympne Aerodromes for civil aircraft used for the carriage of passengers or goods for hire or reward, or for any industrial purpose :—

Class AA.—Small type, occupying less than 500 sq. ft. of floor space : (*a*) 2*s*., (*b*) 3*s*.

Class A.—Small type, occupying less than 900 sq. ft. : (*a*) 5*s*., (*b*) 5*s*.

Class B.—Medium type, occupying over 900 sq. ft. but not exceeding 1,800 sq. ft. : (*a*) 10*s*., (*b*) 10*s*.

Class C.—Large type, occupying over 1,800 sq. ft., but not exceeding 3,600 sq. ft. : (*a*) £1, (*b*) £1.

Class D.—Large type, occupying over 3,600 sq. ft. : (*a*) £1, (*b*) £1 10*s*.

Class E.—Large type, occupying over 3,600 sq. ft., but more than two engines : (*a*) £1 10*s*., (*b*) £1 10*s*.

(*a*) Landing fees for single landing. (*b*) Daily housing fees.

Monthly Rates

Class AA.—Small type, occupying less than 500 sq. ft. of floor space : (*c*) £4 10*s*., (*d*) £6 10*s*.

Class A.—Small type, occupying less than 900 sq. ft. : (*c*) £6, (*d*) £11.

Class B.—Medium type, occupying over 900 sq. ft., but not exceeding 1,800 sq. ft. of floor space : (*c*) £10, (*d*) £20.

Class C.—Large type, occupying over 1,800 sq. ft., but not exceeding, 3,600 sq. ft. of floor space : (*c*) £20, (*d*) £40.

Class D.—Large type, occupying over 3,600 sq. ft. of floor space : (*c*) £36 (*d*) £56.

Class E.—Large type, occupying over 3,600 sq. ft., with more than two engines : (*c*) £36, (*d*) £66.

(*c*) Exclusive of landing fees. (*d*) Inclusive of landing fees.

2. The under-mentioned rates (already published in the "Air Pilot") remain in force at Croydon and Lympne aerodromes for aircraft used for purely private purposes.

Class AA.—Small type, occupying less than 500 sq. ft. of floor space : (*e*) 1*s*., (*f*) 1*s*., (*g*) 2*s*. 6*d*.

Class A.—Small type, occupying less than 900 sq. ft. : (*e*) 2*s*. 6*d*., (*f*) 2*s*. 6*d*., (*g*) 5*s*.

Class B.—Medium type, occupying over 900 sq. ft., but not exceeding 1,800 sq. ft. : (*e*) 5*s*., (*f*) 5*s*., (*g*) 10*s*.

Class C.—Large type, occupying over 1,800 sq. ft., but not exceeding 3,600 sq. ft. : (*e*) 10*s*., (*f*) £1, (*g*) £1.

Class D.—Large type, occupying over 3,600 sq. ft. : (*e*) 10*s*., (*f*) £1 10*s*., (*g*) £1 10*s*.

Class E.—Large type, occupying over 3,600 sq. ft., with more than two engines : (*e*) 15*s*., (*f*) £1 10*s*., (*g*) £1 10*s*.

(*e*) Landing fee for single landing. Housing fees : (*f*) up to eight hours, (*g*) up to 24 hours.

Monthly Rates

Class AA.—Small type, occupying less than 500 sq. ft. of floor space : (*c*) £2 10*s*., (*d*) £3 10*s*.

Class A.—Small type, occupying less than 900 sq. ft. : (*c*) £5, (*d*) £7 10*s*.

Class B.—Medium type, occupying over 900 sq. ft. but not exceeding 1,800 sq. ft. of floor space : (*c*) £10, (*d*) £15.

Class C.—Large type, occupying over 1,800 sq. ft. but not exceeding 3,600 sq. ft. of floor space : (*c*) £20, (*d*) £30.

Class D.—Large type, occupying over 3,600 sq. ft. of floor space : (*c*) £30, (*d*) £40.

Class E.—Large type, occupying over 3,600 sq. ft. with more than two engines : (*c*) £30, (*d*) £45.

(*c*) Exclusive of landing fees. (*d*) Inclusive of landing fees.

3. The fees quoted under the column headed "Inclusive of landing fees" cover all landings carried out by one aircraft in any particular month.

4. In the case of aircraft with wings capable of folding, the class for landing charges will be calculated on the basis of the size with wings open, and the class for housing charges on the basis of the size with wings folded, if, in fact, the wings are folded.

5. The fees charged at Government Air stations other than Croydon and Lympne are not affected and remain for all civil aircraft as stated in paragraph 2 above.

6. *Air Pilot.*—A copy of this notice should be inserted in the *Air Pilot* after page 44A (published in A.P.M.S. 33) and numbered pages 44B, C, D.

(No. 45 of 1928.)

PUBLICATIONS RECEIVED

Aeronautical Research Committee Reports and Memoranda : No. 1118 (*Ae.* 291). A Survey of Longitudinal Stability Below the Stall, with an Abstract for Designers' Use. By S. B. Gates, M.A. July, 1927. Price 1*s*. 3*d*. net. *No.* 1128. (*E.* 27).—Motoring Losses in Internal Combustion Engines. By H. Moss, D.Sc. July, 1927. Price 6*d*. net. H.M. Stationery Office, Kingsway, London, W.C.2.

Meteorological Office Geophysical Memoirs : No. 40.—The 27-Day Recurrence Interval in Magnetic Disturbance : An Examination made with the aid of hourly Character Figures. *By J. M. Stagg, M.A., B.Sc.* Price 1*s*. net. *No.* 37.—Studies of Wind and Cloud at Malta. *By J. Wadsworth, M.A.* Price 2*s*. 6*d*. net. H.M. Stationery Office, Kingsway, London, W.C.2.

Everybody's Aviation Guide. By Maj. Victor W. Pagé. The Norman W. Henley Publishing Co., Putnam Building, 2, 4, 6, West 45th Street, New York, U.S.A. Price $2·00.

The Air Pilot Monthly Supplement. No. 42. *April*, 1928. Air Ministry, Kingsway, London, W.C.2.

Aeronautical Research Committee Reports and Memoranda : No. 1103 (*Ae.* 280).—The One-Foot Wind Tunnel at the National Physical Laboratory ; Including Particulars of Calibration made with a Pitot Tube and Vane Anemometer at Low Speeds. By L. F. G. Simmons and L. J. Jones. April, 1927. Price 9*d*. net. *No.* 1107 (*Ae.* 284).—Further Experiments on a Model of the "Bantum" Aeroplane with Special Reference to the "Flat" Spin. By H. B. Irving and A. S. Batson. June, 1927. Price 1*s*. 3*d*. net. H.M. Stationery Office, Kingsway, London, W.C.2.

Manchester and Aviation. By John F. Leeming, Owlpen, Bowdon, Cheshire.

Traite Pratique de Navigation Aerienne. By A.-B. Duval and L. Hebrard. Gauthier-Villars & Cie., 55, Quai des Grands-Augustins, Paris. Price 30 fr.

Mathematische Strömungslehre. By Dr. Wilhelm Müller. Julius Springer, Linkstrasse 23-24, Berlin, W.9. Price RM. 18.

Skyward. By Commander Richard E. Byrd, U.S.N. G. P. Putnam's Sons, Ltd., 24, Bedford Street, Strand, London, W.C.

AERONAUTICAL PATENT SPECIFICATIONS

Abbreviations : Cyl. = cylinder ; i.c. = internal combustion ; m. = motor. The numbers in brackets are those under which the Specifications will be printed and abridged, etc.)

APPLIED FOR IN 1926

Published June 21, 1928

29,615. M. R. PLANCHT. Rotary i.c. engines. (291,119.)

APPLIED FOR IN 1927

Published June 21, 1928

5,294. A. H. R. FEDDEN, L. F. G. BUTLER and BRISTOL AEROPLANE CO., LTD. Controlling means for i.c. engines. (291,152.)

8,743. C. R. WITTEMANN. Aeroplanes. (268,788.)

13,915. SIR W. G. ARMSTRONG WHITWORTH AIRCRAFT, LTD., H. N. WYLIE and J. RANSOM. Wings. (291,224.)

20,702. C. E. SCHUELLER. Gyroscopic stabilizer. (275,649.)

21,834. E. HALLOWELL. Device for propelling aircraft at high altitudes by direct fluid reaction. (291,263.)

30,369. H. SUKOHL. Air propellers. (291,292.)

30,924. T. B. LOFTHEIM. Screw propellers. (291,293.)

34,627. U. ANTONI. Screw propellers with flexible blades. (291,313.)

APPLIED FOR IN 1928

Published June 21, 1928

4,498. ROHRBACH METALL-FLUGZEUGBAU GES. Means for releasing and dischargingloads from aircraft. (285,376.)

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